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ABSTRACT

Contained in this teacher's guide are educational objectives and numerous field activity suggestions for environmental education. Part one deals with the total environmental education program, primarily developed for fifth grade students, but adaptable to any level, age six to adult. Sample objectives of an environmental education program, general educational objectives, school objectives, and subject areas of study objectives are outlined in addition to a suggested instructional approach and philosophy of environmental education. Part two describes 86 field activities developed for elementary students using the Youth Activity Station, Land Between the Lakes, Kentucky. These are in the areas of life science, earth science, astronomy, weather, conservation, pollution, social science, and language arts. A bibliography, sample program schedule, checklists, and section on writing behavioral objectives are also included. This work was prepared under an ESEA Title III contract. (BL)

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Environmental Education
Objectives and Field Activities

SE 010 658

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ENVIRONMENTAL EDUCATION
OBJECTIVES AND FIELD ACTIVITIES

BY

James M. Major

and

Charles A. Cissell

and

The Paducah Public School
Environmental Education Staff

Under the Auspices of
West Kentucky ESEA Title III
Region I
1967-'68-'69

Local Support 1969-'70

THIRD EDITION
1970

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We must also acknowledge the contribution of many other sources of ideas as well as borrowed materials.

Most of all, the staff wishes to express their deepest appreciation to Candy Cardin, Terrie Ahart, Elsie Waldon, Beverly Lewis and Holly Orgill for without their careful preparation of the manuscript this enlightening book would not have been possible. We would also like to thank Markey Hankins for the talents he displayed in the operation of the printing press.

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ENVIRONMENTAL EDUCATION PROGRAM

CONTEXT:	The General Purpose, General Objectives, and School Objectives of the Environmental Education Program were formulated to best meet the needs of the referent group.
REFERENT GROUP:	age 6 to adult
FACILITY:	Land Between the Lakes, Youth Activity Station
TIME AND SCHEDULE:	To be determined by Director, Environmental Education Program, and School Principal involved. Fifth grade students — 2½ to 5 days at L. B. L. Program can be made to cover students from first grade thru 12th grade for from one day to five days. The only change would be the depth of study. This Program can be used in any area with minor alterations.

ENVIRONMENTAL EDUCATION PROGRAM
WHY?
General Purposes

The environmental education program addresses itself to the need for a general educational effort to produce in future generations interpretations of the profound relationships between resources and ecological balances, regional development, public policy, economics, and human welfare.

The purpose of environmental education is to sensitize people to environment and make them increasingly aware of the ways in which the environment shapes man and the ways in which man shapes the environment both to his advantage and disadvantage.

Outdoor activities are designed to encourage the development of the concept that all living creatures are products of their total environment and that the environment can be modified by man in order to secure a safe, healthful, and peaceful future for himself and his heirs.

The draft of the outdoor activities involves educational procedures which are planned to stimulate learning by firsthand experience and to provide the incentive to make objective resource decisions.

This is way much of the material the public schools have been offering their students from books was first collected, evaluated, and placed in print. Why not take the student to the places where they can collect the information and take it back to the classroom? Why not place the students in the greatest classroom of all, the great outdoors?

ENVIRONMENTAL EDUCATION PROGRAM

SAMPLE OBJECTIVES OF AN ENVIRONMENTAL EDUCATION PROGRAM

OBJECTIVES:

I. KNOWLEDGE

A. To develop an understanding of natural resources.

B. To develop a greater understanding of the historical background of an area.

C. To realize that interrelationships exist between living organisms and their physical environment.

D. To observe and measure where possible pollution of air, water, and the land by man.

II. SKILLS:

A. To encourage the development of social skills.

B. *To stimulate outdoor recreational skills necessary in a natural* habitat.

C. To develop skills utilizing the students ability to see, hear, feel, smell, and taste.

D. To train teachers to utilize resources in the outdoors for an enhancing of both natural and social science instruction.

E. To manifest the cognitive processes of comprehension, analysis, and synthesis through stimulating and creative learning experiences.

III. ATTITUDES:

A. To develop an appreciation for natural resources.

B. To develop an appreciation for the historical background of an area in our case the L. B. L. area.

C. To stimulate greater interest in classroom activities which are related to real life situations found in the local surroundings as well as in the L. B. L. area.

D. To create a desire to develop healthy and physically strong bodies.

E. To promote a desire and a will to protect living and non-living resources important to man and to use them wisely.

F. To visualize the foundation and relationship of mans' artistic and scientific achievement to the natural world.

IV. PROCESS:

A. To make outdoor or environmental education resouces more accessible to all students.

B. This is done by taking students out of the classroom of four walls to L. B. L., National, State, County, or City Parks, farms, or to the schoolyard.

ENVIRONMENTAL EDUCATION PROGRAM

General Objectives

I. Self-Realization
  1. Perceiving man's role in conservation methods relative to plant and animal life
  2. Exploring new avenues of individual creativity that are stimulated by beauty and the setting of the outdoor environment
  3. Acquiring skills in outdoor and environmental living in connection with satisfying experiences
  4. Using life situations in the outdoors for application of school subject matter material
  5. Providing for status needs and feeling of self-dependence
  6. Sensing spiritual thoughts and feelings through contact with nature

II. Human Relationships
  1. A variety of social settings are provided where students can be themselves and where the group relationships and individual feelings are in proper balance.
  2. The outdoor living quarters is considered to be a miniture community where many community problems have their comparable aspects.
  3. Many outdoor activities are possible only through teamwork and group action.
  4. Outdoor experiences offer opportunities to develop new friendships.
  5. There is little dependence on social and economic status and other barriers to real understanding due to the simple and informal manner of living and working in the outdoors.
  6. In the outdoor school activities the teacher is in a better position to establish genuine rapport with participating students.

III. Economic Efficiency
  1. Outdoor experiences offer opportunities for planning and executing purposeful work which will be valuable in earning a living in adult life.
  2. Students witness job opportunities available in vocational and professional areas in wildlife conservation and management, agriculture, forestry, and park management.

IV. Civic Responsibility
  1. The outdoor activities are conducive to a maximum amount of community and group interaction.
  2. Assuming a position of leadership in cooperative work activities is encouraged and is available in the structured outdoor program.

ENVIRONMENTAL EDUCATION PROGRAM

School Objectives

1. To develop a sense of responsibility for the preservation and conservation of our natural resources
2. To acquire the use of the power of observation and curiosity about natural phenomena as an avenue of learning
3. To promote a desire and a will to protect living and non-living resources important to man and to use them wisely
4. To realize that interrelationships exist between living organisms and their physical environment
5. To identify the natural changes in the environment and develop a sober and salutary attitude toward the changes
6. To strengthen the senses through close and accurate observation
7. To promote the growth of a spirit of inquiry and the broadening of interests
8. To manifest the cognitive processes of comprehension, analysis, and synthesis through stimulating and creative learning experiences
9. To visibilize the foundation and relationship of man's artistic and scientific achievement to the natural world
10. To move the learning experience from an entirely artificial setting in the classroom to the real life environment
11. To provide learning activities that cannot be structured in the classroom
12. To provide learning activities which associate and connect learning and living and to enable students to achieve better academic success

ENVIRONMENTAL EDUCATION PROGRAM
AREAS OF STUDY OBJECTIVES

Life Science General Objectives

1. To be able to recognize some of the common plants and animals and natural communities in the Land Between the Lakes area.
2. To observe some of the interrelationships of plant and animal life in different environmental habitats of the Land Between the Lakes area.
3. To know some uses of different plants and animals
4. To recognize the need for conservation of plant and animal life.
5. To catch first-hand glimpses of the daily changes in nature.

Earth Science General Objectives

1. To see some general characteristics of rock strata in the Land Between the Lakes area and to learn how they relate to plants, animals, water and human use.
2. To study the history of rocks and their contribution to soil formation.
3. To learn ways to control erosion and loss of soil fertility.
4. To study the chemical nature of water.

Astronomy General Objectives

1. To be able to recognize some major constellations and their relationship to earth motions.
2. To observe movements of heavenly bodies as a pattern of related behavior.

Social Science General Objectives

1. To be able to realize the impact of the old iron industry on the lives of the people in this area.
2. To be able to realize the effect of the isolation of the area on the lives of the people who lived in the area.

ENVIRONMENTAL EDUCATION PROGRAM
AREAS OF STUDY OBJECTIVES
(continued)

Conservation General Objectives

1. To be able to recognize the evidence of natural conservation.
2. To be able to recognize the evidence and need of man's effort at conservation.

Pollution General Objectives

1. To be able to recognize the evidence of man's pollution of his natural environment.
2. To be able measure in some cases the degree of pollution present in a given area.
3. To be able to recognize the probable ecological result of man's pollution of his environment.

Language General Objectives

1. To be able to record experiences.
2. To be able to write Haiku poetry.
3. To be able to recognize the language is made up of symbols.

ENVIRONMENTAL EDUCATION PROGRAM
PROCESS

The procedure used by the environmental education staff to effect the educational activities of the program for a particular referent group.

The Instructional Approach

The Land Between the Lakes affords many teaching opportunities for the instructional staff.

All of the experiences during the resident stay at Land Between the Lakes are to be considered instructional in nature. However, the educational program refers to those activities which have been planned by the environmental education committee. All areas of operation for a particular referent group are to come under the supervision of the project leader.

Within the broad scope of the environmental education program many possible patterns of instruction are to be considered by the project leader and the field staff for a particular referent group prior to the scheduled trip to Land Between the Lakes.

Each member of the instructional team will answer the following questions:

How will you organize your teaching?
Theme, problem, unit, skill development . . .

How will you plan your teaching?
Planned day by day at LBL, Teacher directed, pupil directed, teacher-pupil directed . . .

How will you teach?
Guided tour, self-directed, problem-solving and discovery approach, lecture, demonstration. . .

What will you teach?
Material related to on-going classroom program, specialty or personal desire of individual, season of the year, present climatic condition. . .

After considering the answers to these questions the project leader will want to determine who will be responsible for particular educational activities.

ENVIRONMENTAL EDUCATION PROGRAM

SOME ACTIVITIES FOR INSTRUCTION

Life Science Activities

- *Finding animal homes; identifying animal signs
- *Mapping different plant communities; making small-plot studies
- Making clue charts for identification of trees, flowers, birds
- Studying animal tracks, making plaster casts, sketching
- Observing animals and keeping field notes on habitats
- Using microscope and hand lens for close study of organisms
- Taking nature hikes

Earth Science Activities

- *Conducting water experiments; pH check, oxygen content
- Collecting rocks, fossils
- Breaking up a rock and studying its properties under hand lens
- Studying a slope at different elevations
- Visit quarry at Land Between the Lakes
- Keeping field notes of observations on a locale before and after rain
- *Conducting soil experiments, pH check, color, texture, moisture content, temperature

Astronomy Activities

- Recording phases of moon
- Estimating time by star position
- Observing moon through telescope
- *Night study of major constellations

Social Science Activities

- Investigation of Center Furnace
- Investigation of Iron Bank Hills (Old Iron Diggings)
- *Visitation of Cemetaries
- *Visitation of Old Homesites

Weather Activities

- *Temperature Ranges
- *Relative Humidity
- *Cloud Cover
- *Wind
- *Atmospheric Pressure

Language Activities

- *Tombstones tell all
- *Keeping a daily diary or log book
- *Look alike/reminds me of exercise
- *"Haiku" - Nature poetry
- *Words are symbols

Pollution

- *Test for solid particles in water
- *Test for solids (Particulates)in air
- *White-Disc Test
- *Life and Oxygen concentration

*Sample activity sheet included--suitable for field experience for referent group, age 10 to adult.

Philosophy of Environmental Education

Environmental (Outdoor) Education is one of the finest innovations in the field of education. Why must children have to be within four walls in order to learn? The fundamental belief of our organization is that the child can and will learn much more outdoors than within the four walls of the conventional classroom.

We have selected as our special objective the enrichment of our current curriculum by teaching the things that directly apply in the out of doors.

Our program has been directed specifically at the fifth grade children, secondarily at the eighth grade, and lastly on the tenth grade biology student. During the 1968-'69 school year, we piloted two first grade classes in a one day visit to L.B.L. This included a visit to the model farm maintained by TVA, the Center Station Museum and one or two woodland trails. Due to the success and enthusiasm of the children, teachers and parents, the 1969-70 school year has seen many of our first, second, and third grade classes on a similar one day trip to the Land Between the Lakes.

During the 1969-70 school year we also expanded our program to include the junior high school and some elementary school Special Education children. Those in junior high school spent two days and one night at the Youth Activities Station and the elementary school children had a one day trip similar to that of the primary unit.

It is the opinion of all of our staff, from the superintendent down through all ranks, as well as our parents that this is one of our greatest and most beneficial additions to our curriculum.

We believe that no teacher should take children into any outdoor area unless that teacher knows the area and knows the subject material to be presented. In order to make sure of this, we believe that all teachers involved must be trained. In the last three years we have conducted or taken part in five or more six-day workshops with a format similiar to the one dated Oct. 19-20, 1968. We have conducted other workshops for administrators. Our training program has reached more than one hundred teachers in our area.

The curriculum for each workshop varies but comes from the following areas of study:

Ecology (plant and animal), Mammal Habitates, Bird Activities, Animal Trapping (All animals, including birds, caught must be released), Insects and Spiders, Geology, Land Froms, Stream Valley, Fossils, Local History, The Local Iron Industry 1840-1912, Social Study of Local Cemeteries, The Model Farm, Soil Testing, Astronomy, Nature Art, Mathematics, Map Study, Compass Operation, Nature Walks, Day and Night Watches (observation using the five senses when alone), Twig Study, Evidence of Water and Air Pollution, and last but more important the leaving of each area, large or small in the same condition one finds it, since each area is a community within itself.

Teachers are shown how this teaching of behavioral science techniques make the student, adult, or child more aware of himself and of his feelings. A very definite effort is made to make it obvious that "True Tranquility can only be Obtained by Contemplation of Nature."

Philosophy of Environmental Education

In addition teachers are instructed in The Designing and Writing of Behavioral Objectives in the preparation of the exercises they will use in their own program. These exercises should pertain to their own classroom curriculum. In our opinion this is one of the most important facets of this type of Educational Innovation. The behavioral objectives make a portion of the evaluation very definite.

The participants are assisted in developing their own program and turn in a rough draft of this program at the conclusion of the workshop. The organization, the assignment of duties and schedule of the proposed activities are vital to the success of any Environmental Education operation.

The reaction of parents in our community has been positive. One problem on the staff is explaining why every child cannot go to the LBL due to the lack of funds and trained personnel. It would appear that from the enthusiasm of administrators in a recent meeting, great efforts will be made in the near future to eliminate these problems to some degree in many school systems within our area.

The Paducah Independent School Districts 1969-70 school year participation involved 2293 out of the 6100 students enrolled in our system.

Parental Reaction:

One mother said: "My little boy went to the LBL for two and one half days and come home a young man."

Another said: "My son went to the LBL fearing his physical education instructor (one of our trained instructors), and came home feeling that this teacher was some sort of god. Jim is a completely different boy and all to the good."

Another said: "This LBL classroom is the greatest thing that ever happened to our children."

One of the prize experiences of one of our project leaders involved Mrs. Doris Crutchfiel
On arrival at the LBL YAS, one youngster approached her with the greeting, "I hate you, I hate you, I hate you." During the two and one half day session this youngster worked in Mrs. Crutchfield's group more than once. When time came to leave, this youngster approached Mrs. Crutchfield to show her the model of a beaver lodge he had made in nature art class. Mrs. Crutchfield praised his work, which was good. Just before the boy got on the bus to leave, he turned and ran back to Mrs. Crutchfield and hugged her. —Can you say that no behavioral change had taken place?

A sixth grade language arts teacher reports that his students are still bringing up their experiences in the LBL as fifth graders a year later.

The director is frequently approached by youngsters with the question, "When can we go back to the Land Between the Lakes?"

Anecdotes of this nature are repeated in some way on every trip to the LBL.

Children take their parents up there on weekends and during the summer to show them around.

James M. Major

WEST KENTUCKY ESEA TITLE III

ENVIRONMENTAL EDUCATION WORKSHOP

Second Session-October 19-20, 1968
Land Between the Lakes-Youth Activities Station

Director: James M. Major

Consultants:
Charles A. Cissell, Ecology
Robert E. Farmer, Earth Science
Doris M. Crutchfield, Contour Mapping, History, and Math
Jane McCool, Map and Compass, and Math
G. Dale Trentham, Earth Science
James M. Major, Daywatch-Nature Walk

Receptionist: Tommy L. Major

AGENDA

Saturday, October 19, 1968

9:00-9:30	Registration and Dormitory Assignment
9:30-10:00	Orientation
10:00-12:00	First Period Red Group-Charles A. Cissell-Ecology Blue Group-Robert E. Farmer-Earth Science Orange Group-Doris M. Crutchfield-Contour Mapping Yellow Group-Jane E. McCool-Map and Compass, Math Black Group-James M. Major- Daywatch Brown Group-G. Dale Trentham-Earth Science
12:00-12:30	Clean Up for Lunch
12:30-1:15	LUNCH
1:15-3:15	Second Period Blue Group-Charles A. Cissell,-Ecology Orange Group-Robert E. Farmer-Earth Science Yellow Group-Doris M. Crutchfield-Contour Mapping Black Group-Jane E. McCool-Map and Compass Brown Group-James M. Major-Daywatch Red Group-G. Dale Trentham-Earth Science
3:15-5:45	Third Period Orange Group-Charles A. Cissell-Ecology Yellow Group-Robert E. Farmer-Earth Science Black Group-Doris M. Crutchfield- Contour Mapping Brown Group-Jane E. McCool-Map and Compass Red Group-James M. Major-Daywatch Blue Group-G. Dale Trentham-Earth Science

5:45-6:15	Clean Up for Dinner
6:15-7:00	DINNER
7:00-8:00	Fourth Period All Groups-Doris M. Crutchfield-History
8:00-9:00	Fifth Period Seminar on Progress of Workshop-all consultants
9:00	Night Owling
Sunday, October 20, 1968	
7:30-8:30	BREAKFAST
8:30-10:30	Sixth Period Yellow Group-Charles A. Cissell-Ecology Black Group-Robert E. Farmer-Earth Science Brown Group-Doris M. Crutchfield-Contour Mapping Red Group-Jane E. McCool-Map and Compass Blue Group-James M. Major-Daywatch Orange Group-G. Dale Trentham-Earth Science
10:30-12:30	Seventh Period Black Group-Charles A. Cissell-Ecology Brown Group-Robert E. Farmer-Earth Science Red Group-Doris M. Crutchfield-Contour Mapping Blue Group-Jane E. McCool-Map and Compass Orange Group-James M. Major-Daywatch Yellow Group-G. Dale Trentham-Earth Science
12:30-1:00	Clean Up for Lunch
1:00-1:45	LUNCH
1:45-3:15	Blueprint Development-Environmental Progress Report
3:15-3:45	Critique
3:45-4:15	Police Dormitory and Pack
4:15	Disperse

THE LAND BETWEEN THE LAKES

The first settlers who came to the land lying between the Cumberland and Tennessee Rivers were hardy adventurers from North Carolina. They floated down the rivers on rafts and seemed to be actuated by the spirit of adventure. These same rivers that furnished transportation into the area formed barriers later and locked these Scotch-Irishmen into a land of fertile farmland along their banks, with a ridge dividing the area between the rivers. The ridge was scarred with small streams which formed land blockades within which sprang self-sufficient communities. These sites are identifiable today by the cemeteries. Evidence of how the people lived and what they believed can still be gleaned from these memorials.

By the early 1840's, while Kentucky was still one of the leading iron producing states, it was found that these hills not only fortified their community but that they were filled with iron ore. This, with the natural deposits of limestone and an abundance of hardwood for charcoal, brought new interest into the "Land Between the Rivers." Dr. T. T. Watson, a handsome, intelligent, humane and rich iron maker was one of the first men to see the potential of the iron industry.

The Hillman family, who boasted of seven generations of Dutch Ironmasters came into the area and built several furnaces and the rolling mills which were on the east bank of the Cumberland. Center Furnace built in Trigg County was known as the "Grandaddy" of them all because of its importance and longevity. Tenny Hillman managed the furnaces until about fifteen years after the War Between the States. He then built the first blast furnace in Birmingham, Alabama. This is now a branch of the U.S. Steel Company.

Another ironmaker attracted to the hills of Kentucky was William Kelly from Pennsylvania. Kelly's ore was on the surface, and after a short time it gave out. He had two impelling forces - natural inclination for scientific work and a shortage of good ore. Kelly thought air was fuel. After a few years he was able to prove this by producing malleable iron (steel) by forcing a blast of air into a furnace filled with molten pig iron. When the oxygen burned, the carbon and other impurities were blown from the mouth of the stack. This discovery had tremendous impact in 1871, when a legal consolidation allowed steel made by Kelly's Pneumatic Process to be called Bessemer Steel. The price of steel was greatly reduced, and the United States became the greatest industrial nation in the world.

In 1860 only one vote in Trigg County was cast for Lincoln as some 800 to 1000 Trigg Countians joined the Confederate Army, and the Hillman furnaces were furnishing eighty percent of the sheet and bar iron to the Confederacy. The victory by the Union forces at Fort Donelson, which gave attention to General Grant as a military leader, made this part of Kentucky and Tennessee very controversial.

By 1912 the fires went out in the furnace stacks and left only many shades of blue and purple scattered waste material in the grotesque hills. The Pennsylvania ironworkers returned to their native homes, and the woodcutters and charcoal burners cleared small fields and attempted to support their families by farming. Kelly's Pneumatic Process had given railroads a boost, and the demand for cross-ties was great. Most of them were made by hand, but a few steam sawmills went into operation. The Hillman Lands were declared a state wildlife refuge, and white-tailed and fallow deer restocked a game area that less than sixty years before was some of the finest hunting to be found.

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With the Scotch-Irish background, the presence of corn, an abundance of firewood, plenty of white oak for barrels and the ease with which whiskey could be stored or shipped, homemade distilleries began to spot the hill sides. Most of these were twelve-to-twenty-barrel stills, but some were as much as one hundred-barrel stills. The spring water that flowed over the limestone rocks and the pride the makers took in their product gave the moonshine a good reputation. It found its way into many organizations, even the national political conventions. The interference of the Federal Government was not welcomed by those people who had found a home in a land almost surrounded by water, withstood a war, been able to survive on the poor soil and had asked nothing from the outside world. The government, however, expected the revenue from this industry. It has been estimated by some officials that the loss in revenue amounted to as much as twelve million dollars some years.

The building of the Kentucky and Barkley Dams and TVA's recent conversion of the Land Between the Lakes to a recreation area has kindled a new fire. To some, it is nostalgia, for others, it is a campfire or a new educational experience that can never be quenched.

Doris Crutchfield

MORE HISTORICAL BACKGROUND

LAND BETWEEN THE LAKES

I. Early settlers

The first white men who came to this part of the country (Laura Furnace, Golden Pond, and Ferguson Springs Precincts) were the hardy adventurers from North Carolina who floated down the Tennessee and Cumberland Rivers on rafts. They seemed to have been actuated by the spirit of adventure and beyond erecting a few rude huts contiguous to the streams, made no further improvements.

Following these came a few families of a more thrifty class of people, but these too disappeared leaving but faint traces behind them. As early as 1793 there was a small settlement near the location of Redd's Tan-yard, where a block house was built as a means of defense against the Indians.

II. Physical location

This three or four hundred square miles of Kentucky and Tennessee is formed by the historic Tennessee and Cumberland Rivers. The Tennessee getting its name from a lost Indian word probably meaning the "Big Bend" and the Cumberland was given its name by Dr. Thomas Walker for the Duke of Cumberland. The region is divided first by "Goober Pea Ridge" which runs somewhat down the center generally following the Trace. The streams that drain from this ridge into the Tennessee and Cumberland Rivers are swelled by rains and back water and form isolated area. These boundries held rather self sufficient settlements. These are noticiable today by the location of a cemetery within many of these sections. A small stream can become important when you have to ferry or ford.

III. Early Government and social life

Poor transportation and communication caused the inhabitants to provide their own government in many instances. Even after County Governments were established, anyone living outside the boundries of a community was considered an outsider, and they did not deem it feasible to settle community problems by outsiders. A recent resident of Golden Pond recalls a shooting when one brother walked a mile down the road, got his gun, and walked the mile back, shot his brother and never stood trial. It just wasn't honorable to get shot. Either you were a nuisance to the society or you just shouldn't have gotten into a scrap.

Often the community or communities were brought together in social events. Many times this was a ball game or square dance and sometimes ended in a shooting. One of these is told in the conversation between L.C. and J.R.B.

IV. Civil War

In 1860 only one out of 1,451 votes in Trigg County went for Lincoln. Some 800 to 1000 Trigg Countians joined the Confederate Army. The Hillman Furnaces furnished 80% of the sheet and bar iron to the Confederate Army. The hanging of Phillip Redd, owner of Redd's Tanning Yards, by the Federal Army or Guerrillas. The victory for the Union Forces at Fort Donelson giving attention to Grant as a military leader. All these things made LBL an important part of the Civil War.

Near the end of the war Captain Given Campbell, born in LBR, was placed in charge of the final little guard of 10 men who escorted Jefferson Davis southward with what remained of the Confederate Treasury. At least four other men in that immortal little band also were from the LBR. Jefferson Davis was captured but the treasury went on to Florida by wagon and was put on a boat on a river and sent out to sea to some country. The Yankees never got it.

The ironic thing in this story is Richard Watkins, a negro who lived near Washington, Ga., told the Yankee soldiers where he had seen some rebels. This lead to the capture of Jeff. Davis . Watkins was so upset over this that he left and never returned to his home. He wandered around to Nashville and finally Trigg County. About the time of the World War I he told his story to Arthur C. Burnett. Mrs. Burnett published the story and Watkins or "Judas 'Ristocrat'" as he called himself, left his wife and children in Trigg County and never has been heard of since.

V. Iron Industry

In the 1830's Kentucky ranked third in iron ore production in the U.S. Dr. Watson was one of the early Ironmasters in 1841 he built the Empire Furnace. It was called Empire because of Watson's vast holdings including a brick house and ice house. Watson lived a colorful life. He died in 1846 leaving an estate of $160,000 to be divided between his children both in and out of wedlock.

Daniel Hillman bought half interest in Dr. Watson's holdings in 1842 and after Watson's death built the Center Furnace. The Hillman family, seven generations of Dutch Ironmasters, built Trigg Furnace, the largest furnace costing $60,000, the Tennessee Rolling Hills etc. One of Daniel Hillman's sons was Tenny - named for T. T. Watson. It has been said that Tenny (T. T. Hillman) "was born and bred in a blast furnace." He was born in Kentucky in 1844 and spent his childhood near Fulton Furnace in Lyon Co. When he was scarcely seven years old the little boy was thrown from his pony, dragged and very nearly killed. For six years he lay an invalid, with his spine permanently injured. When he became older and stronger, his keenest pleasure was hunting and fishing. Among the Hillman household slaves were two big kind black men who were detailed regularly to carry little "Tenny" out into the woods on long hunting and fishing expeditions. These men took faithful care of their young master and when, perched atop their broad shoulders, he brought down his game, they were as proud as though they, themselves, had done the shooting.

During the Civil War young Hillman had charge of both Center and Empire furnaces. There were occasions when these plants were target of both Federal and Confederate forces, the firing line being first on one side of the furnace group, then on the other. Center kept in blast very nearly throughout the war period, and in 1866, Daniel Hillman gave his boy as a present, on his twenty-first birthday, a fifty-thousand dollar interest in the company and made him general manager. The firm name was then changed to "D. Hillman and Son". For the next ten years Hillman worked steadily at the furnace, in the face of the adverse conditions then confronting the iron trade. At length he found it to his advantage to sell out, and this he did, shortly after his father's death. Early in 1879 he embarked in the mercantile business in Nashville, Tenn., purchasing a stock of iron and hardware from his cousins. All over Kentucky and Tennessee there were Hillmans in the coal and iron and allied trades. But T. T. Hillman could not stand being away from a blast furnace. Just about 6 weeks after he had taken up the Nashville proposition, he went to the city of Birmingham. He built the Alice Furnace and came to Birmingham to stay. In 1884 Hillman allowed Col Ensley of Memphis to consolidate the Alice Furnace Co., Pratt Coal and Coke Co., and the Linn Iron Works and thus form the Pratt Coal and Iron Co., Col Ensley held majority control.

Now T. T. Hillman, having in him the blood of more than seven generations of Dutch iron workers, was not one to stand by and see himself ousted by a "Tennessee Horse trader" as some of Ensley's enemies termed him. For instance, when Alice broke the record and turned out one hundred and fifty tons of pig iron, the largest daily run of any single blast furnace in the entire south, in 1886, the way Enoch Ensley took on the glory was enough to stir black blood. So Hillman brooded and figured. He saw that to relieve the situation he must either back out or else get behind the Ensley crowd and buy up the majority stock of the Pratt Coal Co., but he did not have sufficient funds for the latter move. Hillman contacted some friends and enlisted their capital to take up options on the Pratt Coal and Idon Co. They then offered the options to the Tennessee Coal Co. It was a beautiful plan and it worked. When Col. Ensley discovered the true status he turned mad as a bull. It was of no use, however, the trade was in full swing. The very name of the Pratt Co. was submerged in the transaction - conveyed to Tennessee Coal and Iron and R. R. Co., in the year 1886. TCI was phased into the U.S. Steel's Sheet and Tin Operations, plant and functions are still virtually the same as the TCI.

VI. William Kelly

William and his brother John F. Kelly originally from Pittsburgh had a merchantile business in Philadelphia when William met Miss Mildred Gracey and came to Western Kedntucky to visit her. He married Miss Grecey and persuaded his brother to join him in purchasing a furnace and 14,000 acres of ore and timber land on the Cumberland River. The ore was surface ore and when it gave out Kelly was impelled by two forces - natural inclination for scientific work and shortage of charcoal or good ore.

Kelly thought that air was fuel and that by forcing a blast of air into a furnace partly filled with molten pig metal the oxygen of the air would unite with the carbon and other impurities and would be blown from the mouth of the stack by the blast of air. Prior to this time this could only be accomplished by producing a tremendous amount of heat and using an abundance of fuel.

Dr. Huggins and two English employees were the only encouragement he had. It is believed that the Shreve Steel Co. of Cincinnati who ask Kelly not to use his "new fangled process" was the one who told of his idea in England. Kelly later identified one of the Englishmen (by a picture) as being Bessemer. He asked his wife and friend to never tell this as long as Kelly lived.

Kelly demonstrated this process in 1851, however, he had one problem - when to turn the blast of air off. Musket of England found the process of expelling all the carbon and then adding the desired amount. Bessemer became the owner of the patent, but Kelly claimed the patent in 1857.

In 1871 in Wyandotte, Mich. a legal consolidation allowed steel made by the Kelly Pneumatic process be called Bessemer Steel. This is sometimes referred to as the "Crime of the 19th Century". Kelly received $450,000 for his royalties. It did reduce the price of steel greatly and cause the U.S. to become the greatest industrial nation.

Doris M. Crutchfield

The Land Between The Lakes

The Land Between the Lakes is one of the newest and most exciting outdoor recreation and educational areas in America. Nestled between two of the world's largest manmade lakes in western Kentucky and Tennessee, this 170,000 acre area is within an easy drive of more than 70 million people. This is the role of the Land between the lakes today, however importance of position is not new to this area. The historical background of this area is one which lends itself not only to the development of the Kentucky and Tennessee area, but to our nation as a whole.

The first inhabitants of this area, which at the time was the Land between the rivers Cumberland and Tennessee, were the Chickasaw Indians. In 1818 a treaty was made and the United States became the possessor of what is now called the Jackson Purchase Treaty Lands. A sum of $300000.00 in gold was paid for this area, and the Indian legends say that the gold was buried, and to date has never been recovered. White men from North Carolina floated down the rivers to this area and settled, The rivers bordering the area form natural routes of transportation, yet also isolate the area from the surrounding country. The first white settlers were Scotch-Irish, a hardy, adventurous breed of settlers accustomed to living in a communal or clan system of society. For their purposes the Land between the Rivers was geographically perfect.

Geographically the area was divided down the center by a ridge. Today this backbone of the area is the basic route of Highway 453, the "Trace" or as it was known historically, "Goober Pea Ridge". Branching off of the ridge were numerous small streams which divided the area into geographic "squares" having as their borders the river, a stream on each side, and the ridge. It was in these "squares" that the independent, self-sufficient coumunities arose. Because of their ethnic and cultural background, anyone from outside the boundries of a specific geographic "square!" was considered an "outsider" by the inhabitants of that community. Today many of these communities have left cemeteries where they lived, and it is from these memorials that much information can be obtained as to the life and customs of these people.

The decline of wildlife and limited croplands necessitated the seeking of other means of survival for the people in this area. Salvation was to be found in the rolling hills of the land. In the early 1840's, iron ore was found to be in abundance in the Land between the Rivers. Not only was the ore abundant, but it was literally inches beneath the surface of the earth. This coupled with the abundance of limestone and hardwoods for charcoal, brought new life to the area between the rivers.

Dr. T. T. Watson was one of the first to take advantage of this great potential source of iron. In partnership with the Hillman family, whose background included seven generations of Dutch Ironmasters, he soon completed construction of Fulton Furnace. Dr. Watson, whose memorial monument can be seen near Center Furnace, died in 1846, leaving the Hillmans as sole owners of the iron industry which they christened "The Empire". In 1846 the best known, most productive, and longest lived iron furnace was built. Having no better name to give to the furnace, it was named because of its location between two other furnaces in the central portion of the "Empire". Center furnace the "Grandaddy" of them all began its life in Trigg County in 1846. The "pig" iron industry was well under way with seven Hillman furnaces in the Land between the Rivers area. Although new life was given to the "Land between the Rivers" by the iron industry, tragedy was to strike the area, as well as the nation between the years of 1860-1864, the Civil War.

In the election of 1860, only one vote out of 1,451 went for Lincoln from Trigg County. Eight hundred to one thousand men from Trigg County enlisted in the Confederate Army. One of the greatest contributions to the South was made in the form of sheet and bar iron. The Hillman furnaces, operated by Tennessee Hillman, furnished eighty percent of the sheet and bar iron to the Confederacy. Other interesting events occurred during this period of conflict, however two of the most interesting and possibly ironical occur in the "Land between the Rivers".

The first event concerns a Captain Given Campbell, a Confederate officer from Trigg County. When the fall of the Confederacy was certain, a detail of men led by Capt. Campbell were assigned to escourt Jefferson Davis, and the treasury of the Confederacy to safety. While going through Georgia, it was decided that the best tactic to adopt would be to split up the detail, half going with the treasury and the other half going with Jefferson Davis. Capt. Campbell went with the treasury, reputed to be a priceless diamond necklace. Captain Campbell's part of the mission was successful. He delivered the necklace to a port in Florida, and it was sent to some South American country. It has been a mystery since its destination was secret, and died with the Trigg County captain. The other half of the men, including Jefferson Davis were captured in Georgia. A Union patrol was in the area of the detail's camp. They asked a young Negro if he had seen any "rebels". He said that he had and told the man about the camp. All were captuued by the Union patrol. Ironically this portion of the story was never revealed until many years later. Controversy had developed about the attempt to escape by disguising himself as a woman, others said that this was not true. The Controversy reached the "Land Between the Rivers", and the truth was revealed. A local orchard owner, Richard Watkins, revealed the story to Arthur Watkins, Circuit Clerk of Trigg County. He told his unique story about how he was born in Georgia and one day during the final phases of the war was asked if he had seen any of the Confederates. He told them of a camp and followed to watch. He climbed a tree, and to his terror found that he had betrayed Jefferson Davis. In his state of fright, he fled Georgia, going to Tennessee, and finally settling in the "Land Between the Rivers". By this ironic twist of fate, the man who was to protect the President of the Confederacy, and the man who betrayed him unknowingly, lived a significant portion of their lives in the "Land Between the Rivers", probably within a relatively few miles of each other.

The second event concerns a young Union officer. His mission was to capture two important forts in the "Land Between the Rivers". These forts were in the Tennessee part of the area. This young officer not only captured the forts but moved his men up the rivers to a strategic military point and began one of the greatest flanking movements in military history. Later in his life the officer was to base a political campaign on these efforts. Because of his success in the Civil War in the "Land Between the Rivers" the officer, Ulysses S. Grant, was elected President of the United States of America!

Life in the "Land Between the Rivers" was not easy by any standard. Existance was a struggle marked in variety by the degrees of conflict with the land, and, in one case, a conflict which gained world-wide significance.

William Kelly was a young Irishman who had married a girl, Mildred gracey, from the "Land Between the Rivers" area. In 1847, while watching one of the furnaces, Kelly noticed that a portion of the iron burned hotter than the rest and the cause of this seemed to be only a draft of cool air blowing on the portion. With this experience in mind, Kelly decided that this was the key to making "maleable iron" from "pig iron". "Pig iron" was the iron made by the furnaces. It was characterized by a brittle quality that necessitated a two step process of rolling the iron into sheets and reprocessing it to make it "maleable iron" which can be molded into tools. Because of this two step process, the "maleable iron" was expensive, and not used in great quantities. Kelly's idea was that air could be used as fuel to burn the iron ore to a purer quality, which would eliminate the two step process, and make "maleable iron" practical to use in great quantities. Kelly told his wife about his idea. She and her father took immediate action. They locked Kelly in the house and called for the doctor. They thought that he had gone mad. Cool air on hot metal only cools the metal! The doctor examined Kelly and decided that he was not crazy and neither was his idea. The people in the community began to call Kelly, "Crazy Kelly". His experiments soon caused a lack of labor at the furnace, consequently, when he was approached by two young Englishmen who were interested in helping him, he gladly accepted. In 1850 or '51, Kelly was ready for his final experiment. A portion of the air cooled iron was lifted from the furnace. Before it cooled, a blacksmith made a horseshoe and nails from it. "Pig iron" couldn't be made into horseshoes or nails! His experiment was a success.

The next morning. Kelly was surprised to find that the two young Englishmen had fled during the night, leaving most of their clothes and their pay behind. Trailing the two men by bloodhounds, Kelly reached Eddyville wharf and found that the two men had taken a riverboat north and were planning to return to England. Shortly afterwards a patent was applied for by an Englishman named Bessemer. The news spread throughout the world that the "Age of Steel" was at hand. The news was no surprise to the people of the "Land Between the Rivers". One of their own people had developed the process six years earlier. A great legal battle followed and the patent was awarded to Kelly, but due to financial ruin, Kelly sold his patent to his father for $1000.00. Eventually Kelly was to receive $450,000.00 for his royalties from the patent. This, however, was little compared to the millions received by Bessemer, who had obtained the British patent. Later Kelly was to make a confession to his wife. He insisted that it remain secret until after his death. Kelly identified a photograph of Bessemer as being one of the two Englishmen who had fled. Kelly lived to see his invention become the cornerstone of the world's industries, and credit given to a man undeserving. Tennessee Hillman who operated Center Furnace left the "Land Between the Rivers" and built the first blast furnace in Birmingham, Alabama, utilizing Kelly's principal. This furnace was later to become a branch of the U.S. Steel Company.

Although Kelly's idea was to bring about the "Age of Steel" throughout the world, it was one of the principal reasons for a new tragedy in his "Land Between the Rivers". The cheap production of steel gave rise to a new transportation giant in America, the railroad. Rails could be made inexpensively, and they reached to areas that before had been ignored because of lack of transportation. Surrounded by the rivers the "Land Between the Rivers" remained inaccessable. Progress brought about by the railroads passed this area by. New iron ore deposits were being mined throughout the nation. These deposits could be taken efficiently to the blast furnaces in rail centers. There was no demand for the once convenient transportation by the rivers. The furnaces closed. Even old Center Furnace shut down in 1912. By 1919 the Hillman "Empire" had fallen.

In 1919 all of the lands of the "Empire" were declared a State Wildlife Refuge. The once natural deer and other wildlife were released in the area. Most of the ironworkers left the "Land Between the Rivers". A few remained trying to grow crops, and cutting the trees for the railroad ties. Life was hard.

The hard life was endured by the descendents of the first Scotch-Irish pioneers. Among themselves they retained many of the customs of their ancestors. One of these customs was the making of their unique whiskey. This whiskey was of the highest quality. The men took great pride in their product. Many homemade distilleries spotted the hills. With the abundance of wood for cooking and storing, and the corn they grew, they produced the finest of "moonshine:. The term "moonshine" was the result of the Federal Government's attempt to tax the people of the "Land Between the Rivers" for the whiskey. These people lived in an isolated land, surrounded by water; were living in a region of poor soil; had survived the Civil War, and had seen a once prosperous industry die. They were independent people, having never asked for help from "outsiders", including the Federal Government. The government however, expected the tax to be paid. Any whiskey that was sold tax-free was, consequently, labeled "moonshine", illegal liquor.

In recent years the "Land Between the Rivers" or now the "Land Between the Lakes", has again gained national prestige. To the people who lived there it was a loss. They were moved out of the "Land Between the Lakes" when it opened as a national outdoor recreational area. Their culture had survived 150 years of turmoil and triumph. In a limited way their moving was again turmoil, but triumph lies in the heritage that they created. A time of rest has come to the "Land Between the Lakes". It's a special rest that reflects a peace found in nature and in living with nature. Only a few such areas still exist in the world, and this is one of them. The heritage that remains is one of importance and service. The history of the area shows that this is no new task, only the method differs. It is a proud heritage established by proud people, and survives as a tribute to these people in the "Land Between the Lakes".

Lynn Hodges

EXERCISE: Social Studies - Location of Land Between the Lakes

Behavioral Objectives: At the conclusion of these activities the students should be able to:

1. Tell in what states and counties the "LBL" is located.
2. Identify the two lakes bordering the LBL and explain how the two lakes are connected.
3. Identify and explain the reason for having two dams.
4. Identify eight (8) animals commonly found in the LBL.

Rationale:

It is the opinion of the Environmental Education Committee that all students who go to the LBL should have a knowledge of its location (states and counties, the lakes involved, why the lakes were formed, why the canal was constructed, the economic value of the lakes etc.)

We have discovered that many students really have no knowledge of the above factors. The TVA Information Center at Golden Pond, Kentucky, will be glad to furnish you with bulletins such as: Land Between the Lakes; Land Between the Lakes Fact Sheet; TVA Today; Welcome to Lake Barkley; Land Between the Lakes Project Report; and a map of the area. All of the answers to these questions can be found in these bulletins and on the map.

It is our feeling that the stay within the LBL of the students will be much more meaningful as the result of this activity.

Activity I. Location of the Land Between the Lakes

1. In what state or states is the Land Between the Lakes located?
2. In what counties is the LBL located?
3. What is the lay of the land of the LBL with respect to the compass?
4. What lakes border the LBL? On which sides?
5. How were these lakes formed?

Activity II. Purposes behind the formation of the Land Between the Lakes.

1. Who built the dams that formed the lakes?
2. Why were the dams built?
3. Why was the canal at the north end of LBL dug?

Activity III. The economic value of the Land Between the Lakes and the lakes adjoining it.

1. Why are these lakes important to the national economy?
2. Why are these lakes important to the economy of Western Kentucky?
3. What happened to the farms along the rivers when the dams were built? Was this good or bad?
4. What has happened and is happening to the tax base of the counties adjoining the lakes? (Optional)

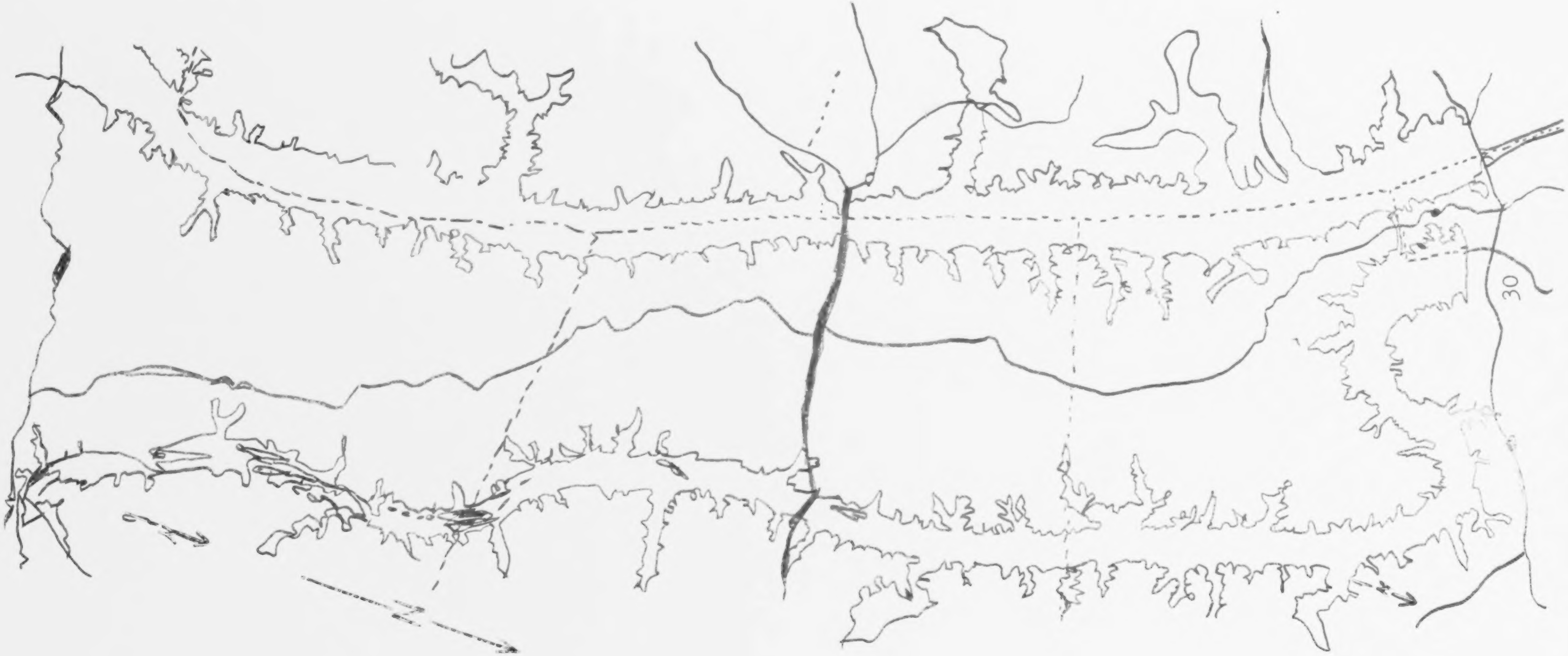
Activity IV. Use of the Land Between the Lakes.

1. What does TVA intend to do with the entire LBL area?
2. Is the use of this area for this purpose good land use?
3. What is the purpose of the 5,400 acre Conservation-Education area?
4. What facilities attract tourists to this area?
5. Why are there so many wild animals found in the northern area of the LBL?

James M. Major

NOTE: Use worksheet map to locate points of interest as well as lakes, rivers, states and counties.

EXERCISE - Social Studies - Location of Land Between the Lakes Work Sheet



FIELD ACTIVITIES

as developed by
Staff and Others

30A

OPERATION DAYWATCH

Exercise - Observation - Use of the senses

Behavioral Objectives:

Following this exercise, the student should be able to:

1. Tell the temperature, wind direction, cloud cover and whether it is clear or cloudy.
2. Tell the plants, the colors, the odors, that surround him.
3. Separate natural from man-made sounds that are audible.

Materials:

Thermometer, compass, pencil and pad

I. Activity - The weather

What is the temperature?

Which direction does the wind blow from?

Is the wind light, moderate, strong?

Is there fog or dew?

Is it clear or cloudy?

Is it raining? snowing?

II. Activity - The sky

What can you see in the sky?

Is the sun high or low?

What colors can you see in the sky?

Date	
Time	Observation

	Time	Observation
III. Activity - The Earth		
What can you see?		
What can you smell?		
How does the ground around you feel?		
How far can you see?		
What living creatures can you see?		
IV. Activity - Sounds		
Describe the sounds that you hear		
What do you think causes these sounds?		
Can you hear sounds caused by humans?		
What are these human made sounds?		
V. Activity - Yourself		
How do you feel?		
What are you thinking about?		
At this point, what would you like to do?		

James M. Major

OPERATION NIGHTWATCH

Exercise - Observation - Using the Senses

Behavioral Objectives:

Following this exercise, the student should be able to:

1. Tell the temperature, wind direction, cloud cover, and whether it is clear, cloudy, raining or snowing.
2. Point out and name two or more constellations.
3. Describe sounds
4. Distinguish between natural and man made sounds.

Materials:

Thermometer, compass, pencil and pad

I. Activity - The weather

What is the temperature?

Which direction does the wind blow from?

Is the wind light, moderate, strong?

Is there fog, or dew?

Is it clear or cloudy?

Is it raining? Snowing?

II. Activity - The sky

What can you see in the sky?

What is the phase of the moon?

What constellations can you see and name?

Are there any "shooting stars"? Where?

Which direction do the "shooting stars" move?

What colors can you see?

Date

Time	Observation

Page 2 - Operation Nightwatch	Time	Observation
III. Activity - The earth		
What can you see?		
What can you smell?		
How does the earth within reach feel?		
How far can you see?		
What living creatures can you see?		
What colors can you see?		
IV. Activity - Sounds		
Describe the sounds that you hear.		
What do you think causes those sounds?		
Can you hear sounds caused by humans?		
What are these manmade sounds?		
V. Activity - Yourself		
How do you feel?		
What are you thinking about?		
At this point, what would you like to do.		

Map and Compass Activity

Behavioral Objectives: Student will be able to take a compass and a map of an unfamiliar area and move with confidence from one area to another.

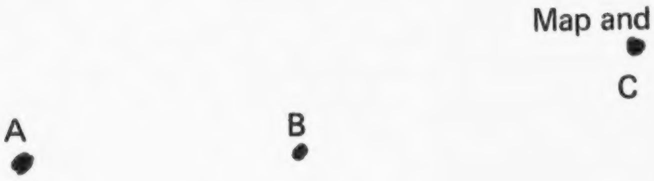
Materials:
Compass
Map of LBL area
Sample Map
Markers

Procedure: Use your compass in solving the sample problems provided by your teacher. After completing this exercise, you will be ready for an outdoor exercise using a map of this area and your compass.

Your group will be assigned certain areas to locate from the map. At each location you will find a marker which you are to collect. After completing the necessary stops, you are to return to your starting point. Groups may be timed during this exercise, and if so, special titles will be awarded each group.

Map and Compass Problems

1.

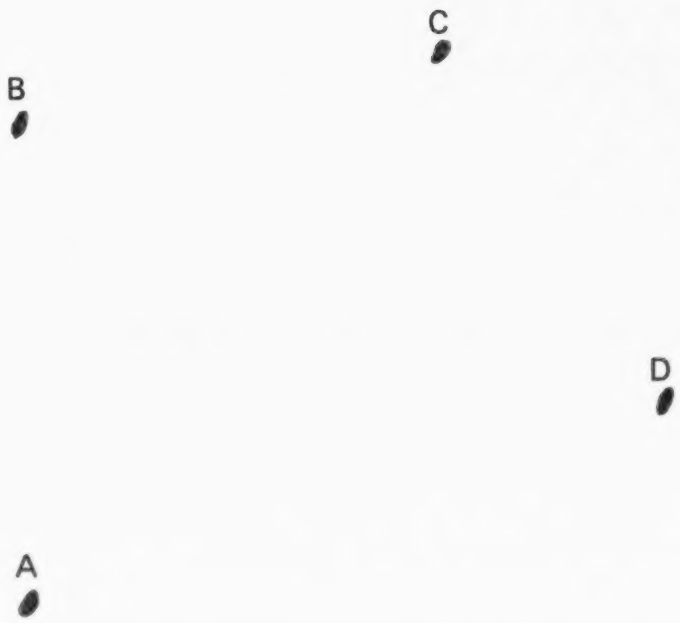


What Compass Reading Do
You get in going from:

A to B ?

B to C ?

2



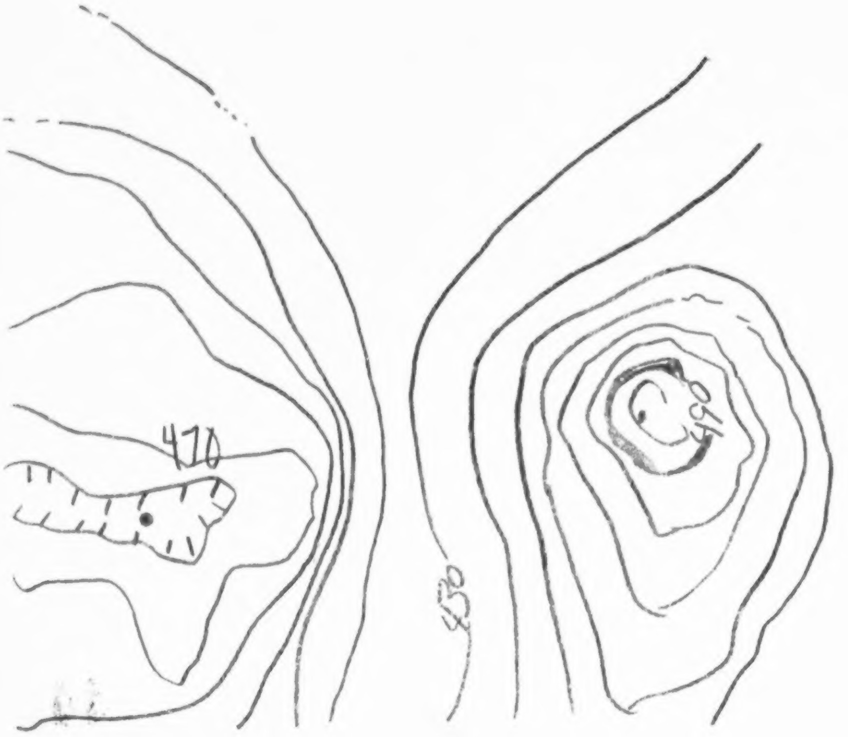
B to A ?

B to C ?

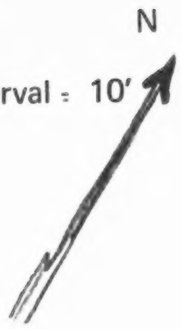
C to B ?

B to D ?

1. What is the height of Hill B?
2. What feature is shown on Hill A?
3. What compass reading do you get from A to B?



Contour Interval = 10′



Dale Trentham

EXERCISE - Compass - Shooting and Following an Azimuth

Behavioral Objectives: After the completion of this exercise the student should be able to:

1. Shoot an azimuth and follow it.
2. Pace a distance.
3. Demonstrate the ability to complete a compass course without reference to land marks, arriving at destination with an error or no more than two paces.

Materials: Compass

Activity:

Compass Course #A

1. Locate a starting point which you can recognize.
2. Shoot an azimuth of 195° and follow it for 60 paces.
3. Shoot an azimuth of 240° and follow it for 40 paces.
4. Shoot an azimuth of 289° and follow it for 70 paces.
5. Shoot an azimuth of 19° and follow it for 80 paces.
6. Shoot an azimuth of 58° and follow it for 70 paces.
7. Shoot an azimuth of 154° and follow it for 65 paces.

Compass Course #B

1. Locate a starting point which you can recognize.
2. Shoot an azimuth of 238° and follow it for 70 paces.
3. Shoot an azimuth of 199° and follow it for 80 paces.
4. Shoot an azimuth of 109° and follow it for 70 paces.
5. Shoot an azimuth of 58° and follow it for 40 paces.
6. Shoot an azimuth of 15° and follow it for 60 paces.
7. Shoot an azimuth of 334° and follow it for 65 paces.

Questions:

1. How do you shoot an azimuth?
2. What was your starting point?
3. How much did you miss your starting point?
4. Why do people whose paces are different arrive at the same place?
5. Did you miss your destination by two or less paces?

James M. Major

EXERCISE: Compass Walk

Behavioral Objectives:

At the conclusion of this exercise, the student should be able to:

1. Make an azimuth reading and follow it.
2. Measure distances in terms of paces.
3. Convert distance in paces into distance in feet.
4. Demonstrate the ability to complete a compass course and arrive within twenty feet of the course destination.

Materials: Compass

I. Activity:

Determine length of one pace (distance between two successive left foot prints) by pacing of 100 feet two or three times and dividing the average number of paces per 100 feet into 100 feet.

Practice taking at least six azimuth readings on six different landmarks.

Follow at least one of the following compass walks:

Compass Walk # 1

1. Start at the flagpole. Take an azimuth of 132° . Walk 76 feet on this azimuth to a large tree.
2. At the tree take azimuth of 140° and follow it 380 feet to a campfire site.
3. At the campfire site, take an azimuth of 274° . Walk about 850 feet to the birdhouse.
4. From the birdhouse, take an azimuth of 20° and follow it about 120 feet to a cedar tree, leaning toward an azimuth of 108°.
5. At the base of the leaning cedar tree, take an azimuth of 55° to the back porch of the dining hall.

Compass Walk # 2

1. Start at transformer pole # 47 on circular driveway. Take an azimuth of 52°. Follow this azimuth 540 feet to a boat.
2. At the boat, take an azimuth of 12°. Follow this to a tree stump near the waters edge.

I. Activity: (cont.)

Compass Walk # 2 (cont.)

3. At the stump, take an azimuth of 288°. Follow this azimuth to trail in woods. You will see a large white box at the end of the trail. Follow trail to white box. (weather station)
4. At weather station, take an azimuth of 196°. Follow this azimuth to main path.
5. At main path, shoot an azimuth of 160°. Follow this azimuth to the rear of the dining hall.

Compass Walk # 3

1. Leave dining hall by rear door. Take an azimuth of 340° and follow until white weather station is in view through the trees.
2. Take an azimuth of 16° and proceed to white weather station.
3. At weather station, shoot an azimuth of 300°. Follow this azimuth to a deer stand in a tree.
4. At deer stand tree, take an azimuth of 161°. Follow this azimuth to a tree with a large patch of lichens about seven feet above the ground (also has several broken limbs leaning against the base of the tree).
5. At this tree, take an azimuth of 116° to an old thorn tree about three feet in diameter at the base.
6. At thorn tree, shoot an azimuth of 170° and follow it to the back porch of the dining hall.

QUESTIONS:

1. What is an azimuth?
2. What is a pace?
3. What is the length of your pace in feet?
4. How do you convert paces into feet?

Robert E. Farmer

EXERCISE -- Contour Mapping

Behavioral Objectives: At the conslusion of this exercise, the student should be able to:

1. Identify a discrete area
2. Convert measurements to scale
3. Read a compass and follow an azimuth
4. Sight a point by using a transit, (Figure 1) and rod (Figure 2)
5. Plot points on a graph
6. Order information gathered by entire group.
7. Interpret the finished contour map

Materials: Polar graph paper, compass, measuring tape, rod, transits, and flags (plastic ribbons tied to wire seg

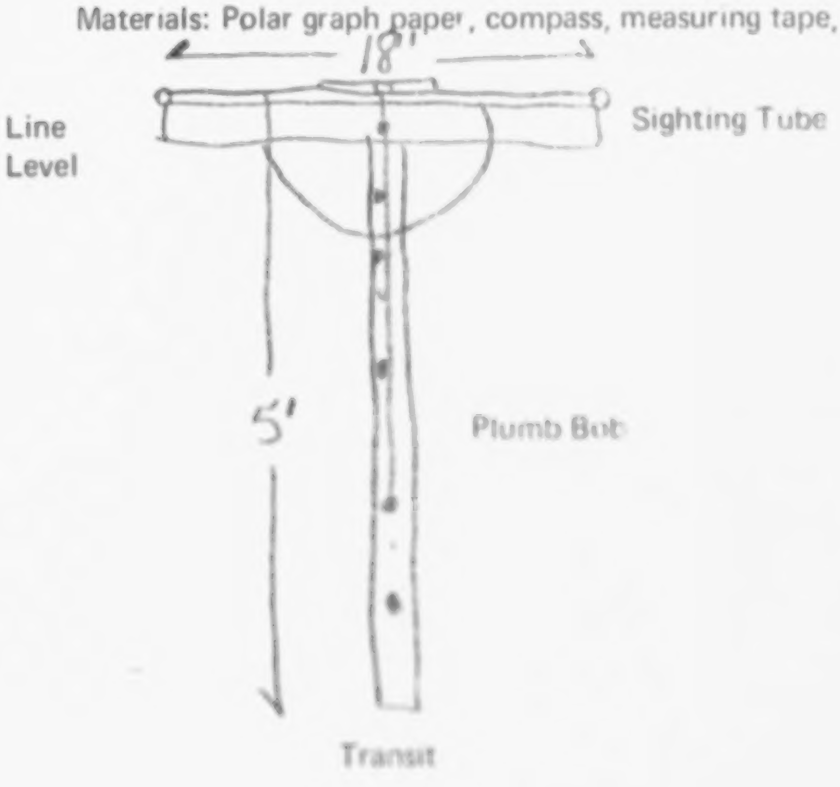


Figure 1

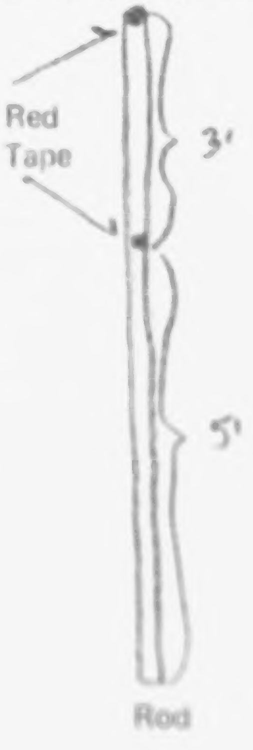


Figure 2

The transit sighting tube can be lower at 1' levels to suit the height of the students. Suitable adjustments can be made with the rod. These dimentions give 3' contour lines with a 5' eye level

Activity:

1. General survey of area to be mapped by the entire group. Fix boundary lines. (An island, wooded area, or other natural boundary is beneficial.)

2. Select a focal point. (Usually the highest point in the area.)

3. Orient the polar graph paper.

4. Establish a reasonable scale so finished map will be appropriate to graph paper. Record this scale in the map legend.

5. Divide into survey teams. Assign each team a specific direction to establish 3 foot changes in elevation from the focal point to the outer limits of area. Mark the outer limits point with a flag indicating the degree reading. (Suggest a difference of 45° between each survey line.)

6. Measure the distance between each 3 foot change in elevation and record these points on the graph paper.

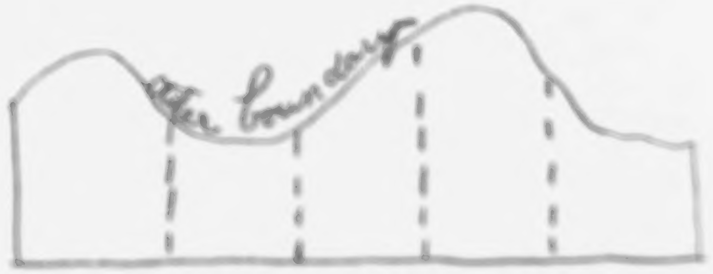
7. Continue the survey lines until the entire area has been plotted.

8. All teams come together to combine data and connect the corresponding points with lines.

Optional:

9. Assign each team the boundary line from the flag placed on the outer limits clockwise to the next flag.

10. Map the boundary, if it is irregular, by laying off a line of reference using a compass to determine direction. Measure offsets by finding the distance from the line of reference to the boundary at reasonable intervals. Adapt these distances to the scale being used and record on the graph paper map. Connect the point to complete the boundary line. (Figure 2)



Line of Reference

11. Combine all boundary lines

Questions:

1. How are the survey lines comparable to the latitudinal and the longitudinal lines?
2. How could the map be more accurately constructed?
3. Can you give any other way to plot the irregular boundary lines?
4. How could this map be beneficial?

Dorris Crutchfield

EXERCISES: Ecological Succession - Plant Communities

Behavioral Objectives: After completing these exercises, the student should be able to:

1. Identify a plant community.
2. Distinguish between deciduous and evergreen trees.
3. Distinguish between woody and herbaceous plants.
4. Identify lichens.
5. Identify mosses.
6. Identify ferns.
7. Identify fungi.
8. Identify grasses.
9. Distinguish different water plants.
10. Point out and count the different kinds of plants in a given area. (Mini-community)
11. Tell the steps in bare rock succession from the rock to the hard wood forest.

TERMS AND SYMBOLS

Community:	All the living things that exist as closely related members in an area.
Ecology:	How living things get along with each other in a community.
Succession:	Any change in plant life in the direction of "higher" forms.
Herbaceous plant:	Any non-woody or soft-stem plant which dies down to the ground at winter - grass, weeds, small flowering plants.
Perennial plant:	A plant lasting or active throughout the whole year.
Deciduous:	Plants which shed their leaves each year.
Evergreen:	Plants which have green leaves throughout the year.
Litter:	Decaying matter covering the earth's floor.
Abundance:	The number of plants belonging to the same kind within a given area.

Deciduous Woody Plants (More than 10 feet tall)

Deciduous Shrub or Bush (Less than 10 feet tall)

Evergreen Woody Plant

Grass and Herbaceous Vegetation

Moss Plants

Fern Plants

Litter

Fungi

ACTIVITIES:

No. 1 - A Land Community - Plant Succession

Purpose: To examine the competitive and cooperative relationship that exists among the living things in a small area. We want to measure the abundance of the different kinds of plants found in the community.

Your teacher will mark off an area and assign you a starting position.

Each student will make a map of the area. Make symbols like those shown on page 1 to represent the kinds of plants you find. Count the number of the largest plants and draw in a symbol to represent each one where you see them growing in the community. Do not attempt to count all the grasses, but put symbols in the grass area.

BE AS CAREFUL AS YOU CAN TO RECORD ACCURATELY THE NUMBER AND KINDS OF PLANTS THAT ARE FOUND GROWING IN THE COMMUNITY.

Exercise No. 2

A STILL WATER COMMUNITY - A Small Pond

Describe the appearance - size, color, structure - of the plants found:

1. Floating on the surface of the water.

2. Below the surface.

3. On the bottom. (Use weighted line and hook)

4. Do you see plants growing up out of the water? What kind?

5. Are all water plants the same?

6. How are they different?

Succession of Plants

7. Do you see any animals attached to the plants?

8. Decay materials from plants and animals settle down on the bottom and fill up the pond. Would the pond fill up more rapidly in the deep or shallow water?

9. Why?

10. How do the plants living on the bottom of the pond get sunlight?

Exercise No. 3 - A Bare Rock Community

Purpose: To compare the kinds of plants found in the pond with those found growing on rock surfaces.

Remember that each area you study - small or large - is a Community. It is only a small part of a larger Community.

The plants you find growing on the rock surfaces represent the 1st stage (primary) of plant succession.

1. Examine the plants CAREFULLY WITH YOUR MAGNIFYING GLASSES.

2. Describe the color of plants.

3. How large are the plants?

4. Are they anything like the plants you found in the pond? How are they different?

5. Do you find these plants growing as SINGLE individuals or growing in a MASS or COLONY?

6. Do you know what a LICHEN PLANT is?

7. It consists of 2 plants. Can you name them?

8. How did these plants find their way to the rock surfaces?

9. Do you see any flowers on the plants?

10. Would you call them "flowering" or "non-flowering" plants?

11. Do you suppose the lichens are breaking down the rock surface into smaller particles?

NOW TURN TO A COUPLE OF NEAR-BY TREE TRUNKS.

1. Carefully examine the trunks for small forms of plant life.

2. Do you find any?

3. Are they anything like those found on the rock surfaces?

4. Do you think all the lichens are the same size and kind?

Exercise No. 4 - A MOSS COMMUNITY

Purpose: To compare the moss plants with the kinds of plants found in the water and with the lichens found on the rocks.

1. What is the color of mosses?

2. Are they larger or smaller than lichens?

3. Do they have roots?

4. Do they have stems?

5. Do they have leaves?

6. Are they flowering or nonflowering plants?

7. What are the soil conditions where the moss plants are growing?

8. What are the "light" conditions of the moss Community?

Exercise No. 5 - A FERN COMMUNITY

1. Do you find mosses in the Fern Community?

2. Are the ferns considered "lower" or "higher" than mosses?

3. Why are the ferns larger than the mosses?

4. Do the ferns have roots? Stems? Leaves?

5. Are the ferns "flowering" or "non-flowering"?

6. Do you see any improvements over the soil conditions found here compared with the bare rocks and moss communities?

7. Did the plants have anything to do with the changes of the soil?

8. Do you find any "higher" forms of plant life growing among the mosses and ferns?

Exercise No. 6 - OPEN FIELD COMMUNITY

Purpose: To observe small seed plants establishing themselves and making a soil conditions suitable for "higher" plant forms to invade the community. We will want to LOOK CAREFULLY for as many different kinds of plants as we can find.

Your teacher will first have you observe a small area the size of a hula-hoop in the open field Community and then direct you to the small stream Community for a comparative study.

Make a list of the different kinds of plants you are able to find. Look very carefully on the surface of the ground.

Count the number of each kind of plant in each of these two Communities.

Exercise No. 7 - THE WOODLAND TREE COMMUNITY

Purpose: To observe how all the plants have built up the soil enough to establish the "higher" form of plants--the flowering, woody trees.

Observation only.

Are all the woody trees the same kind?

Would you say there is variety among the woody trees?

Can you detect any soil improvement?

Exercise No. 8 - A FUNGUS COMMUNITY

Purpose: To compare color, size, structure, and place of growth with other kinds of plants we have found.

Look for plant life on the trunks of fallen trees and dead stumps.

Are the plants "green" or "non-green"?

How do they get their food?

Do you find any similar plants growing on the living trees?

Do they have leaves?

Do they have flowers?

How do they make new plants?

Are they "lower" or "higher" than green plants?

Charles A. Cissell

Exercise: Fungus Among Us

Purpose: To study reproduction in a mushroom.

Behavioral Objectives: At the conclusion of this inquiry the student will be able to identify:

A. Spores of a mushroom

B. Gills of a mushroom

Materials: Fresh mushroom, sheet of white paper, glass tumbler, small brush, microscope slide, cover glass, compound microscope, glycerine: water solution 1 1, knife.

Each student is to go out into the field and collect a mushroom. Bring it back to the laboratory. Examine it.

The mushroom itself is the fruiting body of this particular fungus. It consists of a stalk and umbrella-like cap. Look at the underside of the cap and find the gills. Cut the cap from the stalk and put the cap, gill side down, on a piece of white paper. Cover the cap with a tumbler or some other object that will protect it from air currents. Set the cap, paper, and tumbler in a place where it will not be disturbed. The next day uncover and remove the cap by lifting it straight up from the paper.

1. What do you observe on the paper?
2. What is the relation between what you see on the paper and the structure of the mushroom cap?

With a small damp brush, remove some of the material on the paper and place it on a microscope slide. Add a drop of glycerine and water solution. Examine under both low and high power.

3. Approximately how many particles are there in the sample you are observing?

4. Using this number, estimate the total number of such particles coming from the mushroom.

5. If we assume that these particles are reproductive spores, how could you account for the fact that the world is not covered with mushrooms?

6. How numerous would mushrooms be if they only produced a small fraction of the number of spores seen here?

Appropriate for grades 5, 8, 10

Joe Milam
Rickie Hicks
Shirley Menendez

EXERCISE: PLANT POPULATION ANALYSIS

Purpose: To understand the structure of the community, identify interrelationships between species and to estimate the relative importance of species.

Behavioral Objectives. At the conclusion of this investigation the student will be able to:

A. identify a tree, shrub, seedling, sapling, and herb.

B. calculate the population density of trees, shrubs, seedlings, saplings, and herbs in a quadrat.

The number and kinds of plants in any environment are usually determined by counting all specimens in a given sample area. The two kinds of areas used most frequently are squares and strips, the former called quadrats, the latter transects.

If many quadrats are to be established by using a rope or chain of a certain length, and then marking out a square with it. The type of vegetation to be analyzed determines the size of the quadrat. Thus a square with 10 meter sides is often used for trees, 5 meters for shrubs, and 1 meter for herbs. The smaller squares may be within the larger, and thus the number of shrubs in the 5 meter square multiplied by 4 will give the projected number of shrubs in the 10 meter square, and the number of herbs in the 1 meter square multiplied by 100 will give the projected number of herbs in the 10 meter square. Counting is sometimes implemented by the removal of the plants as they are noted.

Where the vegetation is varied in type, so that selecting typical quadrats is difficult, a transect may be used. This is a line or strip of narrow width extending through a community. All the plants in the strip or along the line may be enumerated. A scheme similar to that employed in quadrats may be utilized to simplify the counting of trees, shrubs, and herbs.

Gathering plant data. In a forest community it is convenient to divide plants into three groups: trees, shrubs, and herbs.

A tree is a tall woody plant with a single stem (trunk). Trees over 5 cm in diameter (about 16 cm in circumference) are studied in the main quadrat. Some attempt should be made to identify the kinds of trees; usually the end of a twig with a few leaves is a sufficient specimen. Trees that form the canopy (the forest top, which receives a direct sunlight) should be noted separately from those that do not reach the canopy. If comparisons are to be made between areas studied by different teams, a count of the trees (either by species or just as "trees") should be made. A further refinement may be made by measuring the trees with calipers (for diameter) or with a tape (for circumference).

Shrubs are woody plants that branch at or near the ground and therefore lack trunks. Saplings are simply young trees with trunks 1-5 cm in diameter. Both shrubs and saplings should be studied in an area smaller than that used for the trees. If the trees have been identified by species, then the saplings should be, too. Counts of the saplings may be made and related to the counts of trees of the same species. Because it is often difficult to distinguish individuals, counts of shrubs may have to be approximate.

Herbs (in the ecological sense) are nonwoody plants that die back at least to ground level in winter. (In the tropics they are more difficult to describe.) Tree seedlings are very young trees with stems less than 1 cm in diameter. Both herbs and seedlings should be studied on small quadrats, but you may wish to have several of these per team area. A spade may be used to dig a small trench along one side of the "herb quadrat," and the relationships between the underground parts of the plants may be noted. Note, also, the presence of toadstools, mushrooms, and other fungi. Again, if your class is making a comparative study, counts of the different species of herbs and saplings should be made. Finally, the proportion of this quadrat that is covered by moss may be estimated.

In nonforested areas the directions given above can be adapted to the nature of the community. Special problems may arise, however. In a lawn, for example, there is no need to count blades of grass; but a count of the "weeds" might be of some value, especially if comparisons are made between a well-trodden area and a protected one. A frame may be useful for this work.

Studying the Data The data gathered by each team must be exchanged with other teams. This can best be done by placing team data on stencils from which copies can be made for all members of the class. Team leaders should devise a form that will permit easy comparison.

Here is a sample of questions you should consider:

1. What producers are in the community? This can be answered by using general terms like "trees," "shrubs," etc., or by naming the various species in your list.

2. Are producers abundant or rare? This may be answered in general terms or with density figures.

3. If there are different groups of producers, which one of them seems to contribute the most toward producing food?

4. Are there layers of producers? If so, what relationships can you find between producers in different layers?

5. Does the community produce all its own food, or is food carried in from beyond the community boundaries? What evidence do you have for your answer?

6. What consumers are in the community? This, too, may be answered with such general terms as "insects," "spiders," "birds," etc., or with names of identified species.

7. Which consumer orders (first, second, etc.) are represented? What evidence can you point out that supports your answer?

8. If some quantitative data have been obtained, what relations can you find between the numbers of a particular organism and the numbers of another organism that eats it?

9. Besides evidence of food relationships, what evidence do you have that any one species in the community affects another?

A survey of a community should raise more questions than answers. In studying the data, part of the job is to look for questions that need answering.

Appropriate for grades 9 and 10.

Joe Milan
Mickie Hicks
Shirley Menendez

EXERCISE: PLANT SUCCESSION

Aim:

To show the change in vegetation in one area over a period of 125 years.

Concepts:

1. As different plants come into an environment the environment changes.
2. As the environment of a plant changes, the plant becomes better suited or poorer suited to the environment.
3. When the environment of the plant becomes too unsuitable, the plant will die.
4. The replacement of one plant by another over a period of time follows a predictable pattern.

Vocabulary:

1. Environment
2. Succession
3. Ecology
4. Climax vegetation
5. Shade tolerant

Evaluation:

1. How do plants affect environment?
2. How do animals affect environment?
3. What are some other factors influencing environment?
4. What is ecology? Give examples.

Procedure:

1. Locate a grassy, open field near a forest.

   a. If a piece of open land in the eastern U.S. is left completely alone by man, it will eventually be covered by large timber. This process may take up to 125 years.

      The purpose of this lesson is to demonstrate the various stages a piece of land goes through over this 125-year period. At each stop, you must imagine that you are looking at this original piece of land at some future date.

   b. This is what the land looks like in 1968.

   c. What is the vegetative cover? Answer: Grasses

   d. We are now ready to take a time machine trip into the future.

2. Locate an opening similar to that above but covered by brush or saplings two to five years old.

   a. This is 1971.

   b. Do you think these plants have heavy or light seeds: NOTE: Pine, sumac, elm, and sassafras are typical light-seeded plants; oak, and hickory are heavy seeded plants.

   c. Why do most of the plants here have this type of seed? Answer: Oak and hickory seeds fall, roll, or are carried by squirrels to their locations; thus they are usually close to a parent tree. Pine, sumac, elm, and sassafras are blown or carried by birds to their location; thus they may be found far from the parent tree.

   d. Note the understory plants. There are still many grasses and weeds growing here.

3. Locate an area which was once open but now has trees 6 to 12 years old on it (6 to 12 feet tall).

   a. This is 1976.

   b. Note the understory. Are there many grasses and weeds, or have these been replaced by different plants? Why? Answer: The environment has changed; there is no longer adequate sunlight for the original vegetation.

   c. What is this replacement of one type of vegetation by a different type called? Answer: Plant succession.

6. Locate a stand of small sawtimber-size trees (12 to 16 inches in diameter).

   a. This is 2023, the larger trees are 50 to 60 years old.

   b. Are there more or less small trees and brush in the understory than there was in the pole stand?

   c. Why? There are more small trees because the environment has developed to the point where it is favorable for the growth of shade-tolerant plants. Maple and pawpaw are two examples of trees that can live under the shade of larger trees.

   d. Why are some of the smaller specimens of sun-loving plants such as oaks and hickories dying? They are less vigorous trees that cannot tolerate the competition for light or moisture. This natural thinning gives the stronger trees more room to grow.

   e. Why are some of the overstory trees considerably larger than others?

      Answer:

      (1) Some of the smaller trees are the same age as the larger ones but are losing the battle for moisture and light.

      (2) Some of the smaller trees came in to fill in space after short-lived trees such as sumac and sassafras dies out.

7. Locate a stand of large mature sawtimber (16 inches and larger in diameter).

   a. This is 2093, the largest trees are about 125 years old.

   b. Are there more or less understory trees than in the small sawtimber stand. Answer: More.

   c. Why?

      (1) Some of the larger trees have died creating open spaces. There was an abundant supply of seeds on the forest floor to take advantage of the available light and moisture.

      (2) Many supressed trees live as inconspicuous seedlings until the overstory starts to open up. These supressed trees are large enough to be noticed now.

d. What are some other factors that may have influenced the change in vegetation?

Answer:

(1) Animals could have influenced the change. For example: A sudden increase in the rabbit population here due to the filling of Lake Barkley resulted in a shortage of food. The rabbits almost completely eliminated the sumac for one season and much of it failed to come back because the sweetgum took its place.

(2) Fire (non Occurred on this particular location).

(3) Others

e. The total relationship between a plant and its environment is known as plant ecology. What are some of the environmental factors we have covered thus far?

(1) Competition between plants for light and moisture.

(2) Influence of animals on plants.

4. Locate an area once open but now covered with trees four to six inches in diameter.

a. This is 1981, the trees are 12 to 15 years old.

b. Note the understory. There is very little sumac and similar species left.

c. Observe the overstory. Trees with short lives such as sassafras look unhealthy if there are even any left. Slower growing trees are overtopped and are losing the battle for moisture, light, and minerals. Competition among plants of the same species is evident.

5. Locate an area once open but now covered with pole-sized trees (4 to 10 inches in diameter).

a. This is 1991, the trees are 15 to 30 years old.

b. How many different species of trees are there left in the overstory? Answer: The overstory consists almost entirely of oaks and hickories—the short-lived trees have died out.

c. How many understory species are left? Answer: The understory is almost bare because very little sunlight and moisture is available.

d. Do you think that the small timber in this stand will grow as tall and straight as the small timber growing on an old field? Why? Answer: Many of these trees have crooked tops and poor form because they were supressed so long.

e. Predict how this area will look in another 100 years without any management.

Answer:

(1) Trees of all ages present.

(2) More shade-tolerant trees in the overstory.

(3) More heavy-seeded than light-seeded plants.

8. Forest management includes manipulating the ecology of an area to produce the most desirable trees. Some of the ways this is done include the following:

a. By harvesting groups of trees to create openings. Even-aged groups of sun-loving trees will soon become established in these openings.

b. By cutting or chemically killing undesirable trees.

c. If this area were covered with pine trees, man could keep it in pine by burning off the understory every two to five years. Pines are much more resistant to fire than hardwoods.

d. By harvesting the less vigorous trees before the entire stand is mature, man can improve the growth of his best trees by giving them more light and moisture. At the same time, man can get income from his tree crop before it is fully ripe.

T.V.A. FORESTER LESSON PLAN

Outdoor Education--Land Between the Lakes

Title: A Study of Deciduous Twigs--Winter or Early Spring

Objectives:

1. Develop skill in making accurate and thorough observations.
2. Develop skill in communicating observations both verbally and visually.
3. Develop skill in being able to distinguish both pertinent and irrelevant physical properties.
4. Develop skill in comparing different science objects in order to determine likenesses and differences between them.
5. Develop skill in constructing a suitable classification scheme built upon observed data or the ability to devise an identification scheme or both.

Procedure:

Each student should have a 10 X lens.

Attention should be called to a particular twig (suggest hickory)

Students should be urged to record all observations they can. (On request names of structures should be furnished by instructor, such as bud rings, bundles, leaf scars, pith, lenticels, node, terminal bud, lateral buds, alternate buds, and opposite buds)

Students should describe their observations and should be asked to make a line drawing of the twig.

Students be encouraged to indicate any abnormalities due to injury from climate and insects.

Students should have their attention called to other twigs--oak, tree of heaven, walnut, poplar, sycamore, maple, ash, sweet gum, etc. (It is only necessary to avoid too many of the same genera in order to have twigs with different characteristics)

After several twigs have been observed, the students, would be asked to see if they can find a way to classify the observed twigs (possibly by a dichotomous key if time allows--or by separating them into groups by specific observed characteristics)

Common Name	Genera
Tree of heaven	Ailanthus
Ash	Fraxinus
Walnut	Juglans
Sycamore	Plantanus
Maple	Acer
Popular	Populun
Hickory	Carya
Oak	Quercus
Buckeye and Horse Chestnut	Aesculus
Tulip tree	Liriodendron

TWIG KEY

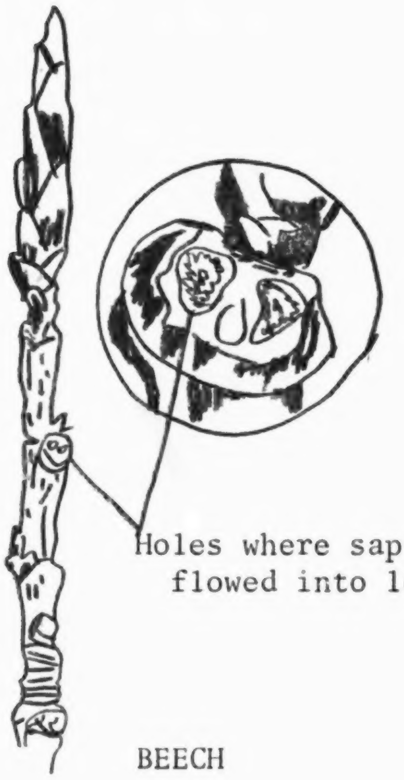
DIRECTIONS: Examine the twig. Then read carefully descriptions A and AA. The twig must be described by one of these points or it cannot be identified by this key. (A maple twig, for instance, fits in point A, since it has opposite leaf scars.) Then proceed to the points under A, taking B and BB, and so on until you have an answer. If the twig you are trying to identify fits first under AA, then consider next the descriptions under E and EE, and so on until you have an answer.

A. LEAF SCARS AND BUDS OPPOSITE EACH OTHER. SEE B AND BB.

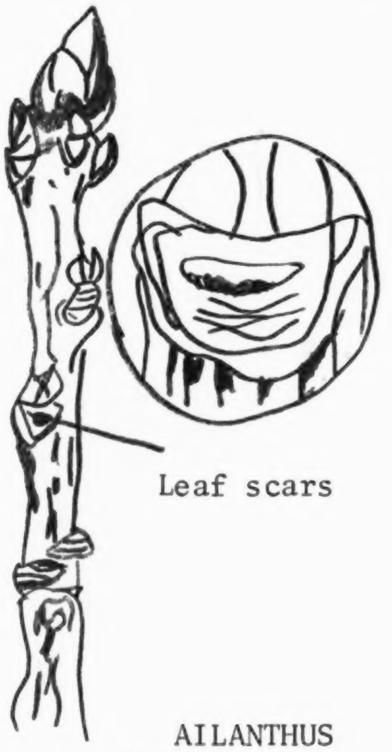
- B. Twigs and buds red to brown: the maples. See C and CC.
  - C. Buds brown, sharp-pointed: sugar maple
  - CC. Buds reddish brown, blunt: silver maple
- BB. Twigs stout, gray-brown, buds dark to black: the ashes. See D and DD.
  - D. Buds rusty color, bark brown with diamond-shaped figures: white ash
  - DD. Buds black, bark gray, smooth: black ash

AA. LEAF SCARS AND BUDS ALTERNATE ON TWIG. See E and EE.

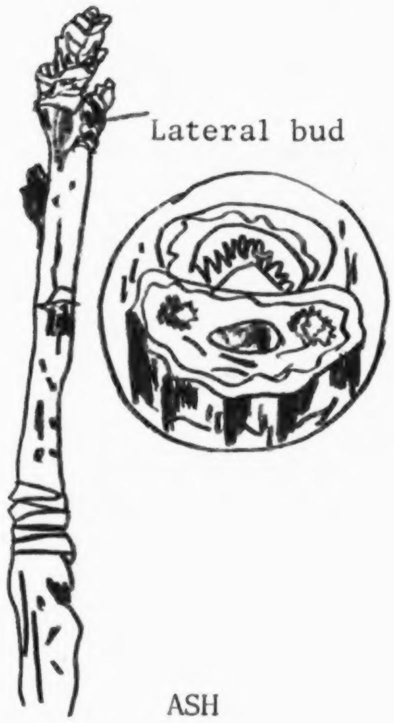
- E. Terminal, or end, bud with a cluster of other buds around it; fruit is an acorn: the oaks. See F and FF.
  - F. Buds sharp-pointed: the black oaks
  - FF. Buds blunt-pointed: the white oaks
- EE. Terminal bud borne singly. See G and GG.
  - G. Buds with three or four scales standing away from bud, bark in loose, hanging sheets: shagbark hickory
  - GG. Buds with close-fitting woolly scales, pith in twigs cream-colored: black walnut


Holes where sap
flowed into leaves

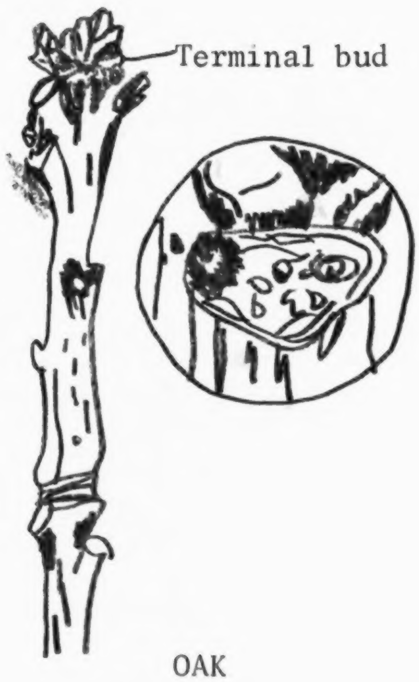
BEECH



AILANTHUS


Lateral bud

ASH


Terminal bud

OAK

Exercise: FLOWERS

Purpose: Our purpose here will be to examine the structure of a flower and to determine the reproductive functions of its various parts.

Behavioral Objectives: The students will be able to:

1. Identify the structures of a flower
2. Contrast and compare the same structures in different flowers.

Materials: Flower, hand lens, razorblade, or knife

Each student is to go out into the field and collect one flower.

Before you dissect the flower to see the parts on the inside, look at the outside.

The outermost whorl of floral parts may be green, leaflike parts which protected the flower bud when it was young. These are called sepals. In some flowers, lilies for example, sepals seem to be lacking. Actually they are present and look like an outer whorl of petals. Petals are usually large and colored, and lie just inside the sepals. Both sepals and petals are attached to the enlarged end of a branch. The enlargement is called the receptacle. These three parts of the flower are called accessory parts because they are not directly involved in sexual reproduction.

1. What functions can you suggest that petals might have?

Now review the structure of the essential parts of a flower by stripping the sepals and petals away. You will find a central stalklike body surrounded by five to 10 more delicate stalks, each ending in a little sac. The small sacs are anthers in which thousands of tiny pollen grains are produced. Each anther, with its slender stalk, is a stamen, and these make up the male parts of a flower. The number of stamens varies according to the kind of flower.

2. What is the number of stamens on the flower you are using?

3. What are some of the ways in which pollen is carried from the anthers to the female part of a flower?

The central stalk surrounded by the stamens is the female part of the flower, called a carpel or pistil. It is composed of an enlarged basal part, the ovary, above which is an elongated style ending in the stigma.

4. How is the stigma adapted to trap the pollen grains and to provide a place for them to grow?

With a very sharp razor blade, cut the ovary lengthwise. Using a hand lens or dissecting microscope, look at the cut surface.

6. How many ovules can you see inside the ovary?

7. How close to the egg can a pollen grain get?

8. If the pollen grain cannot get the egg directly, how do you suppose the sperm cells produced by the pollen reach the egg?

Appropriate for grades 5, 8, 10

This exercise is limited to a time when the students can collect 1 flower each in the field.

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Exercise: Pond Community

Purpose: To develop skills in doing field work in the pond community

Behavioral Objectives: After conclusion of this investigation the student will be able to

1. State specific examples in the area that fit into the pyramid of numbers.
2. State examples of food chains observed.

Pond Community

As lakes fill in, they eventually reach a stage at which the water is so shallow that any thermal stratification is quickly destroyed by the wind, and thermoclinea never form. The rooted aquatic vegetation becomes more conspicuous, occupying a greater percent of the bottom area of the lake. It may eventually extend entirely across the lake; under the circumstances, the lake usually is called a pond. It will still be very productive and may especially harbor many species of amphibians, reptiles, and invertebrates. The benthos will contain abundant organisms in all regions.

Due to the shallow nature of the pond, the temperature will be more like that of the air, becoming warm in the summer, and freezing over quickly in the winter (in the colder climates). The many animals and decaying organisms present may use up all the oxygen under the ice, resulting in suffocation of the occupants.

The abundant vegetation will hasten the final filling of the pond. As it approaches extinction, it may dry up during the dry months, but have enough water in it to support organisms during the wet season. In such instances, the organisms must be able to form spores, migrate, or withstand drought, and this creates an unusual community, known as the temporary pond community.

The shores of ponds will reveal the future development of the pond, for as the pond fills in the shoreline approaches the spot that used to be the center of the open water. From the open water to the shoreline, the following plant zones or communities may be observed: submerged aquatics, floating aquatics, emergents. From the shoreline to the climax community around the pond, the following zones may be seen: rank herbaceous vegetation, shrub, temporary tree, and climax forest. As succession proceeds, each community will replace the one next to it toward the center of the pond. The final stage in the standing water succession will be completed when the climax community covers the area once occupied by water.

FIELD WORK IN THE POND COMMUNITY

Obtain water samples from locations as directed by the instructor, and from them determine the oxygen and carbon dioxide concentrations, and pH. Also note the temperature readings from these locations. Determine the depth of the water.

Collect plankton samples, to be examined for composition later. Numbers and kinds of species present should be noted. Dip nets may be used to collect large invertebrates, and seines for fish, organisms from mud bottoms. Note kinds and abundance of all animals found.

Make careful observations on the plant life present, from the submerged aquatics in toward shore, including the floating aquatics and emergent aquatics. Also observe the zones of communities on shore, from shoreline back to the climax vegetation (if any) around the pond. What are the dominant plants of each zone?

In what ways are the physical conditions of each zone different from the preceding zones?

Is this pond relatively productive?

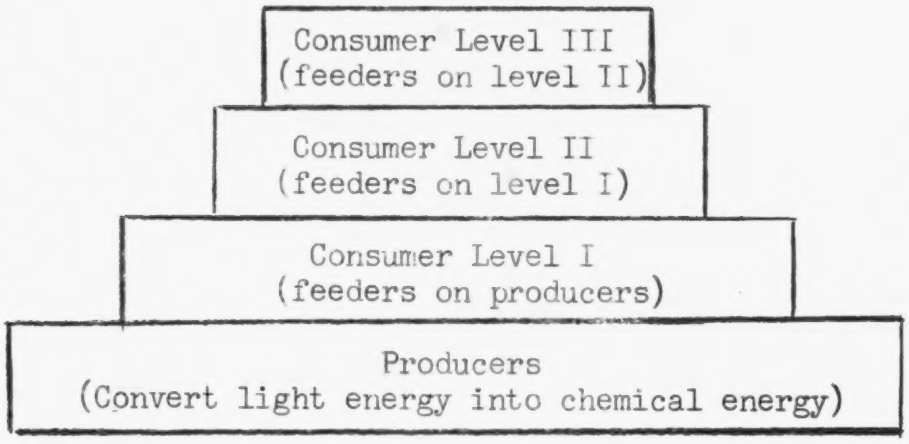
What factors may affect its productivity?

How will its productivity affect the rate of succession of the pond to dry land? List the kinds and numbers of organisms in each trophic level (see P.).
Does this represent the true picture of energy flow through the community?

Appropriate for grades 5, 8, 10.

J. Milam
R. Hicks
S. Menendez

PYRAMID OF TROPHIC LEVELS IN FRESHWATER COMMUNITIES


Consumer Level III
(feeders on level II)
Consumer Level II
(feeders on level I)
Consumer Level I
(feeders on producers)
Producers
(Convert light energy into chemical energy)

Examples of organisms belonging to the various trophic levels:

Producers

- Photosynthetic bacteria
- Floating algae
- Attached algae
- Bryophytea
- Submerged, floating, and emergent vascular plants.

Scavengers

Feeders on dead organic matter, often in particulate form, from all trophic levels

- Bacteria
- Protozoa
- Planaria
- Nematodes
- Rotifers
- Bryozoans
- Anaclids
- Cladocera
- Copepods
- Ostracods
- Amphipods
- Blackfly larva
- Clams

Consumer Level I

Feeders on phytoplankton
- Protozoa
- Sponges
- Tardigrades
- Bryozoans
- Cladocerans
- Rotifers
- Copepoda
- Haliplid beetles
- Mosquito larva
- Clams
- Snails
- some fish (e.g., gizzard shed)

Feeders on larger plants- Bryophytes and vascular plants
- Nematodes
- Crayfish
- Mayfly larva
- Snails
- Ducks
- Muskrats, beavers

Consumer Level II

Feeders on zooplankton
- Planaria
- Rotifers
- Nematodes
- Cladocerans
- Copepods
- Blackfly larva
- Mosquito larva
- Juvenile fish

Feeders on larger invertebrates
- Dytiscid beetles
- Odareta nymphs
- Water scorpions
- Dragon flies
- Water bugs
- Small fish
- Frogs, salamanders
- Turtles
- Birds

Consumer Level III

Feeders on larger invertebrates and small fish,
- Large carnivorous fish such as trout, pickerel, bass, sunfish
- Large frogs
- Turtles, snakes
- Birds
- Otter

Exercise: Clue Charts for Identification of Trees. This exercise can also be used for the study of flowers.

Purpose: To make them aware of and familiar with the various types of trees--their various leaf shapes--the length it takes a tree to grow to maturity---the average height of a family group--usage.

At the end of this exercise the children should be familiar with the following:

1. Know at least 15 types of trees, if not more.
2. Know the section of the country they are dominant
3. Know some of the reasons why they will not not grow in other sections of the country.
4. Know the usual length of time it takes for a full grown tree.
5. Know the height of the family groups.
6. Know the main usage of the wood from these trees.
7. Know their various leaf shapes

Materials needed:

1. A plastic bag for collecting specimens of the various trees in that area.
2. A note pad and pencil or ball point pen
3. Microscope to study specimens
4. Manual - "Master Tree Finder" by M. T. Watts

Why study trees?

Trees are the only source for lumber in building wooden houses as well as for fuel for some homes at the present time.

Everyone that is teachable should know the various trees in the section of the country where they live. This is important for building as well as for planting trees for the beautification of your homes.

Knowing the various types of trees is also important if you are interested in making a living growing them.

If this exercise is modified to study flowers, students will need the manual - "Flower Finder" by M. T. Watts.

Corine Glore
Northside Elem.

Exercise: Microsuccession in Rotten Logs

Purpose: To investigate the various stages of microsuccession and the types and relative abundance of life associated with each type of rotten log communities.

Behavioral Objectives: At the conclusion of this exercise, the student will be able to :

A. Identify trees representing the various stages in microsuccession.

B. Compare and contrast the types of life in the various stages of microsuccession.

C. Compare the quantities or relative abundance in each kind of rotten log.

The principle of succession may be demonstrated in microhabitats within a community, such as plant galls, fecal droppings of large mammals, and rotting logs. In each case, the microhabitat undergoes physical and chemical changes which accomplish its destruction, and its remains become a part of the soil of the community. The physical and chemical changes are brought about by biotic forces primarily. Bacteria, fungi, invertebrates, and vertebrates all aid in changing the original microhabitat.

In case of the rotting log microsuccession, the changes may begin while the dead tree is still standing. At that time certain insects and other invertebrates may inhabit the bark and outer wood. Birds and mammals may use hollow parts for nests.

The tree finally falls to the ground after being weakened by the boring insects and the rotting effects of bacteria and fungi. The bark is probably already off, and thus the first inhabitants of the tree will now be replaced by new ones. The wood will be further riddled with boring, and more fungi may gain entrance to the inner parts of the wood.

The plants and animals change the wood both physically and chemically, until once again, a new kind of community is found in the log. At this stage, the inside of the log may be "punky", while the outer shell remains firm. In such a condition, logs often serve as homes for small mammals such as the common shrew and white footed mice, as well as lizards and salamanders.

Eventually, even this outer shell disintegrates under the attack of organisms, and the log, now nearly a part of the forest floor, plays host to still a different set of organisms. For example, many of the smaller snakes like the ring-necked and worm snake find this habitat suitable to their needs. These will finally disappear as the log is completely decayed.

Procedure: FIELD WORK IN ROTTEN LOG MICROSUCCESSION

In any one log, the succession from the dead tree stage to the stage where the log has become part of the forest floor takes several years. Observation of this succession may be witnessed in a few hours by examining several logs of the same species in the same community, at different stages of decay. The instructors will indicate trees representing stages in the microsuccession, and the class may then make various observations on these stages.

Stage I: Standing dead tree.

Is there bark on the tree? If so, is it easily removed? Is the wood hard and dry? What invertebrates can you find under the bark, or in the wood? Are wood borers present? Are any vertebrates, such as squirrels or birds, nesting in the tree? Record all species of animals found.

Stage II Newly fallen tree.

Is there any bark on the tree at this stage? Is the wood firm or soft, wet or dry? What invertebrates are found in it or in the wood? Are any borers present? (An axe may be necessary here to observe deep tunnels in the wood.)

List all species and their relative abundance.

Stage III Log rotting inside, but hard on outside.

Lift off the outer shell, and closely examine the contents. Break apart the shell, being careful to note all invertebrates. Rake through the punky part of the log, being especially watchful for lizards, snakes and salamanders, as well as invertebrates. Record all species and their numbers. Are there any mammal runways in or under the log?

Stage IV Completely rotten log.

Rake through the rotten wood as in the stage three log, noting all species observed and their quantities. Is the wood more moist or less so than in the previous stage?

In which stage were the most kinds of animals found? In which stage were the most animals of all species found? What is the most striking physical difference between the first and the last stage of the succession? How can you describe the chemical difference between the first and last stages?

Appropriate for grades 5, 8, 10.

Joe Milam
Rickie Hicks
Shirley Menendez

EXERCISE: THE RELATIONSHIP OF MOISTURE AND LIGHT TO TREE GROWTH

Objective:

To provide field exercises to show the growth and development of individual trees.

Concept:

1. The forest is made up of groups of trees rather than individual trees.
2. Each tree lives in a slightly different environment and this environment affects the growth and development of the tree.
3. The growth of a tree depends on a combination of environmental factors including available light and available moisture.
4. Different species of trees have different characteristics.

Vocabulary:

1. Competition
2. Environment
3. Photosynthesis
4. Suppressed
5. Crown (of tree)
6. Pruning

Materials:

Increment borer

Evaluation:

1. Why do open-grown trees have more limbs?
2. Where does a plant get its food?
3. Why do trees in valleys grow faster and larger than trees on ridges?
4. How is a tree like a factory?

Instructional Procedure:

Effect of moisture on plant growth.

1. Review the concept of environment.
2. Discuss the environment of two trees with emphasis on available moisture (one tree on moist site, one on dry site).

Point out each tree's environment.

a. Are there larger trees around it? How many are competing for moisture?
b. Are there smaller trees around it? How much competition do they present for moisture?
c. Are there grasses, herbaceous plants and brush? How much water do they use?
d. Is the soil here moist or is it dry? Why do you think this? How deep is the local water table?
e. What is the exposure of the site to the sun? Does it face north, south, east, or west? North and east sites are generally more moist than south and west facing slopes.

3. Take core samples on the two trees.
   a. Count annual rings.
   b. Point out the difference in growth rate - relate this to available moisture.
   c. Point out the difference in growth rate in years of drought.
   d. Trace the history of the area by the width of the growth rings.

Effect of light on plant growth

1. Pick out two trees of the same species, one open grown; the other in a dense timberstand.
2. Discuss the environment of the trees.
   a. Are there large trees around it? How much sunlight can the tree get from the sides? from directly above?
   b. Are there smaller trees around it? Do they get much light? NOTE: Certain species of trees are tolerant of shade and can grow and prosper in the shade. Soft (red) maple is a species so adapted. Generally the more valuable species require much sunlight.
   c. Are there many grasses and bushes around the tree? Generally there is less of this type of vegetation in a dense timber stand.
3. Compare the age and growth rate of the two trees. Take core sample to do this.

4. Have the class discuss the effect of light on plant growth.
   a. Point out that both light and moisture were in greater availability in the open grown plant.
   b. Briefly go into the concept of photosynthesis. Explain the inter-relationship of moisture and light.

A green plant gets moisture form the soil, carbon dioxide from the air, and uses these as the raw materials to produce a simple sugar. Sunlight provides the energy necessary to make this change. (Oxygen and some water are given off in the process.)

This simple sugar has the same role in the life of a tree as food does in the life of a human. The basic sugar made into more complex materials such as cell walls by the addition of elements and minerals (minerals come from the soil).

   c. Ask why the open-grown tree has more limbs and a greater crown. Answer: The lack of sunlight causes forest-grown limbs (lower limbs) to die and fall off but in the open-grown trees, these limbs get enough light to survive.

T.V.A. FORESTER LESSON PLAN

Behavior of An Orb-weaving Spider

Purpose: To investigate the behavior of an orb-weaving spider in web-weaving and predatory prey relationships in several webs.

Behavioral Objectives: At the conclusion of this investigation the student will be able to:

1. Draw a diagram of the web.
2. Identify the orientation of the web.

In most parts of the U.S. the orb-weaving spiders are easily found throughout the warmer parts of the year. One of the common species is the golden orb-weaver, Argiope aurantia, which in some areas is, extremely abundant. This exercise is best performed where at least several webs may be observed.

In a suitable habitat chosen by the instructor, divide into small groups and locate webs of an orb-weaving spider. Observe and record for each web the following data:

1. position of the spider in the web
2. orientation of the web in respect to direction
3. orientation of the web in relation to the earth, (e.g. vertical, horizontal, or at what angle)
4. draw as accurately as possible a diagram of the web

Gather a number of insects of suitable size (e.g., small grasshoppers, leafhoppers, flies, etc.). Without casting a shadow on the web or disturbing it in any way, toss an insect so that it is caught in the web. Observe and record the activities of the spider. How long does it take it to reach the prey? Does it approach directly or by a devious route? What is its first activity in respect to the prey? Does it bite at once? How does it immobilize the prey? Does it then begin to feed immediately or does it leave its prey? Repeat the operation as many times as required to observe and understand fully the responses of the spider.

Cut or break one of the main supporting strands of the web. Observe and record the response of the spider. Does it immediately set about repairing the break? How does it operate? Where does the silk for repair come from? Is the repaired web identical in form and structure to the original one? What happens if you break more than one thread simutaneously?

By carefully placing a wire hoop under the web, you can fasten the main supporting threads to the hoop with cellulose tape or masking tape. Capture the spider and place it in a jar, then collect the net with as little damage as possible. You can then transport both spider and web to the laboratory. Here you can make as many observations on its behavior as time and ingenuity permits. What happens if you alter the orientation of the web with respect to direction? Light? Plane on the earth?

Will the spider feed normally with the position of the web altered? What effect do changes in temperature, humidity, chemical stimuli, etc., have on the spider's behavior?

A spider removed from its web and placed in a suitable artifical environment will build a new web. If time permits, observe and record the exact order of events of web-building. Will the spider build in the dark? If so, does this web look the same as one built in the light?

Appropriate for 5, 8, 10.

By
Joe Milam
Rickie Hicks
Shirley Menendez

Exercise: Bird Behavior

Purpose: To observe various types of bird behavioral patterns and estimate the bird population of the area.

Materials:
1. Binoculars
2. Bird identification book

Behavior Objectives:

1. Identify behavior patterns that are characteristic of certain birds.
2. Compare the relative abundance of certain kinds of birds in the area.

Procedure:

Designate an area of suitable size for the class (This is to be determined by the teacher).

Make a cover map of the area, indicating major vegetational types, and draw grid lines on it. Each student can then be assigned a portion of the area in which he will walk the grid lines during the period of time alloted. Each student will proceed along the assigned route, walking very slowly (preferable in early morning). If a bird is observed, stop walking, and do not make any fast movements. Raise binoculars slowly to your eyes. Do not attempt to follow the birds you sight. Mark on your area map each bird observed, indicating by standard sights any activities and the direction in which the bird moved. Watch for behavior actions, such as manner of flying, feeding, communications, habitat where seen, etc.

Note any behavioral actions exhibited such as:

1. manner flying-darting, undulating, soaring, flapping, alternate flapping and gliding, etc.
2. special actions-tall wagging, darting from perch and quickly returning, continual hopping about, climbing tree trunks
3. feeding-method of feeding, type of food
4. communication-calls, songs, drumming or pecking where the birds are while communicating
5. habitat in which seen, and location of the habitat (e.g., oak-hickory forest in upper branches)
6. distress action - how did it react when it saw you?
7. interrelations with members of its own species
8. interrelations with members of other bird species

In the classroom, all observation can be gathered and correlated, and the bird population of the area can be estimated.

This exercise is appropriate for grades 5, 8, 10.

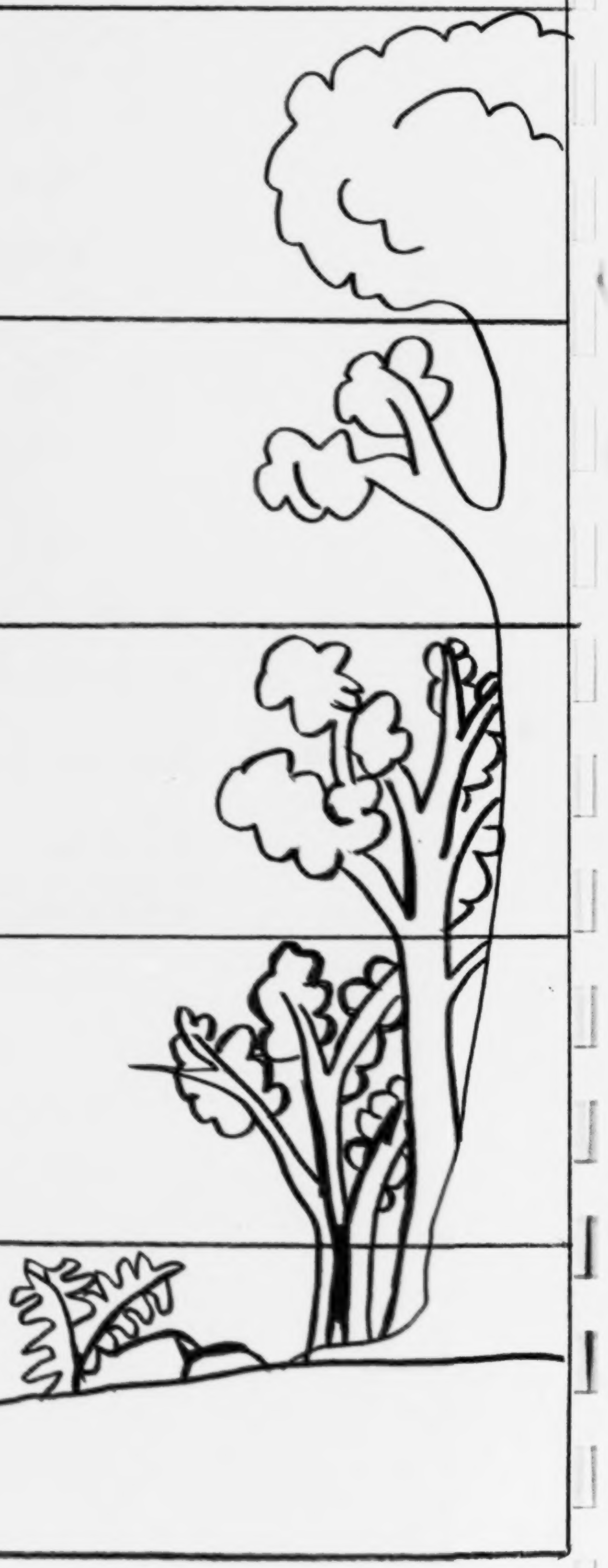
Joe Milam
Rickie Hicks
Shirley Menendez

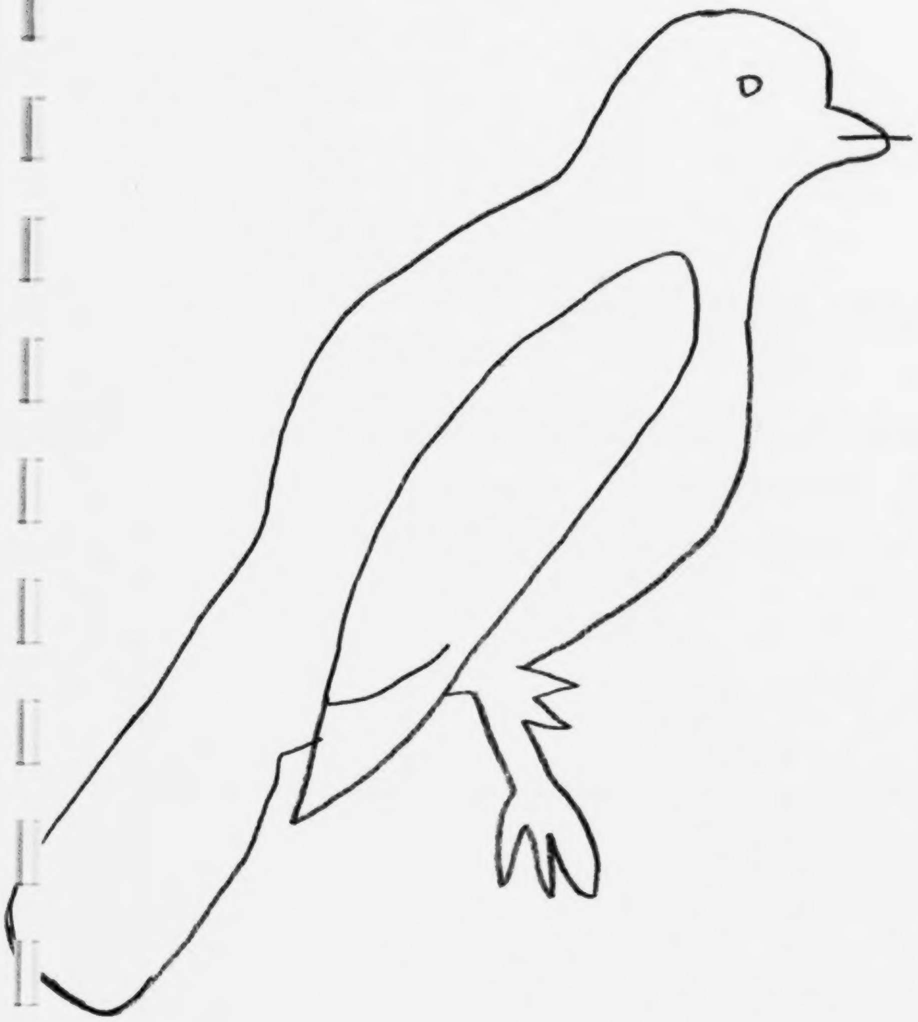
OBSERVING BIRDS IN THE WOODS

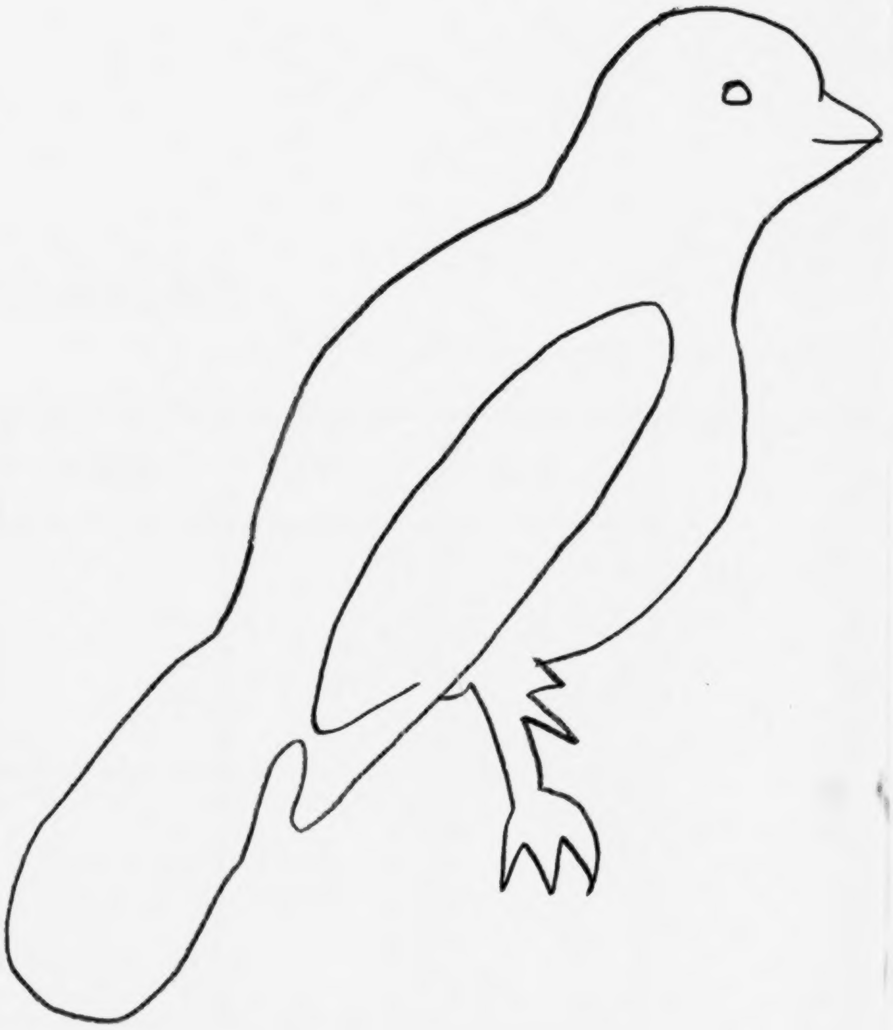
Date____________________________ Weather____________________________

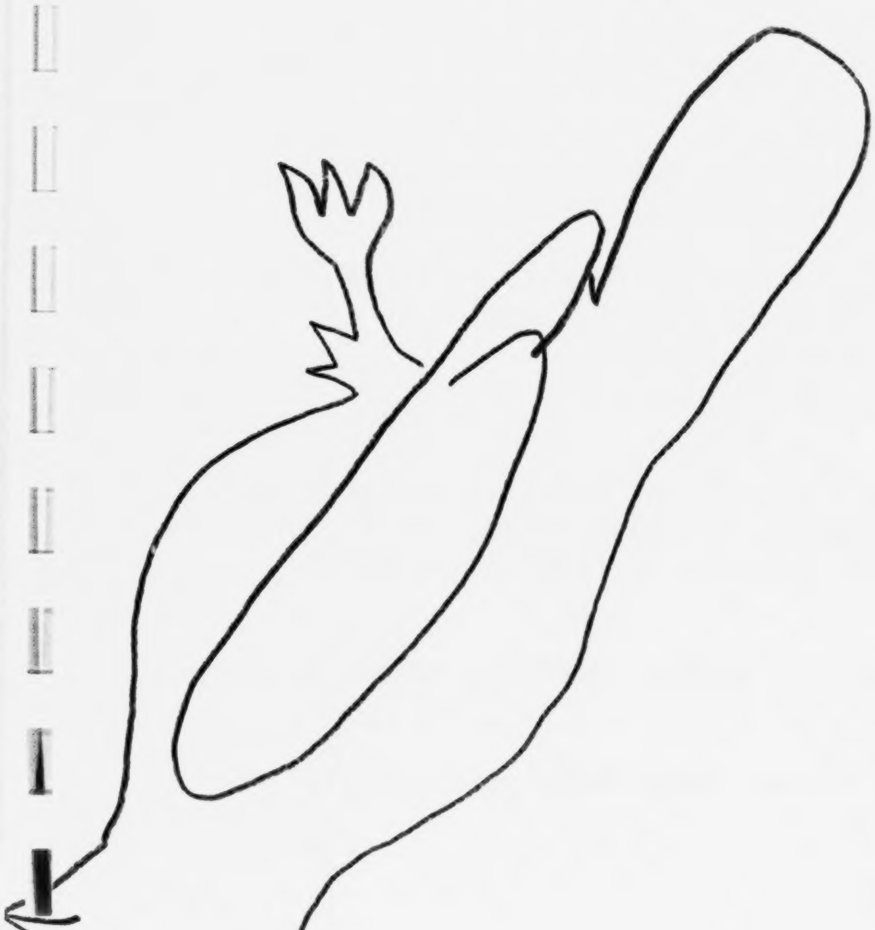
Names and numbers of birds and/or nests observed in the layers of the forest.

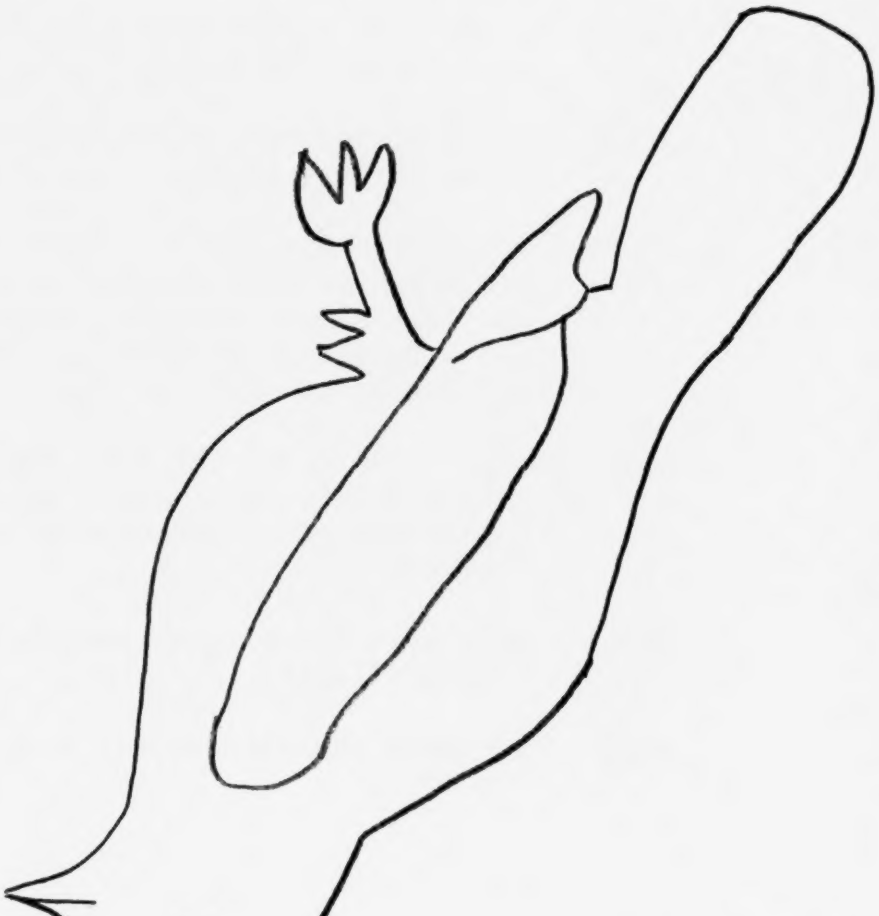
Overhead	
Topstory	
Overstory	
Understory	
Shrub	
Herbaceous	
Floor	











CLUE CHART FOR BIRD IDENTIFICATION

SIZE	SHADE	SHAPE	SURROUNDINGS	SWEEP	SONG

Bird Characteristics

Size - Is the bird larger than a sparrow (6 inches)? or a robin (10 inches)? or a crow (20 inches)?

Shade - Areas of the body where colors are located (variations in color at the throat, belly, wings, tail, and markings of feathers)

Shape - a. body shape (plump, sleek, thin, short and stubby, or streamlined)
b. head and bill shape (bill is thick or thin or long or short)
c. Tail shape (rounded, wedge, square, notched)
d. wing shape (rounded, pointed, ragged)
e. leg shape (long or short)

Surroundings - Where was the bird located: (tree top, vertical position on tree trunk, in a wooded area, meadow, telephone wire, fence post, prairie, along the country road, swimming or floating on water, other)

Sweep - What were the flight characteristics? (jerky, darting, swooping, irregular flight)

Song - Are there phonetic sounds such as "raspy, chip-chip, peter-peter?" or a trill?

BACKGROUND MATERIAL FOR ANIMAL ECOLOGY

HOLES

Burrows and other openings used by animals seem to have a natural appeal for children. The shape and size of the opening can lead to interesting speculation as to its purpose. Is the opening in use? What is it being used for? Did the animal that is using the hole construct it? Might more than one kind of animal use it? Is it placed so that the owner can observe from it without being seen? Is it in a good spot for warmth? What does its location in a river bank or at the base of a tree tell about the habits of the owner? What can be learned about soil composition from the opening?

Many sorts of openings in the earth are dug or used by many different kinds of animals. These openings range from the earthworm or crayfish tunnels to bears' dens and the nests of kingfishers and bank swallows. Tracks and signs of food will give excellent clues to identifying the users of these openings.

To discover if an opening is currently in use, a student could lay small pieces of material across the mouth of the hole. If the material has been pushed aside after a length of time, something is using the hole.

Wildlife managers and zoologists can identify mammal burrows in the field from a sample of guard hairs collected from the animals that occupy the burrows, a simple key, and a magnifying glass.

The hair samples can be collected with the aid of some soft number nine or twelve gauge wire that has been hammered flat. These are shaped into loops. A wire is then placed where it will be rubbed by the passing animal. The rough edges will collect some of the animal's hair as he pushed through the hole. The animal is uninjured in this process except for the loss of a few loose hairs. If no wire is available in the field, it would be worthwhile to try some rough-barked wood, wood with cuts in it, or burdoct-like vegetation that might pull off hairs.

WHERE TO LOOK

To the uninitiated, almost any small hole in the ground is a "snake hole." However, a bit of observation and patience usually proves it to be the burrow of one of the small mammals.

Natural openings: Mice, as a rule, do not dig burrows. They will sometimes use those dug by other animals, but usually seek natural openings among rocks and lots.

Chipmunks generally find openings in rock piles. The openings of their homes are usually about two-inches across with no dirt piles at the entrances. What happens to the dirt? It is often hidden among the rocks and roots at a second entrance.

Small funnel-shaped depressions can be the result of skunks digging for food. Often skunks move into the abandoned burrows of other animals. Let your nose be your guide, but don't be fooled by the skunk-like odor of foxes and some members of the mink family.

Tunnels and trenches: Tunnels where moles have pushed up the surface soil as they "swim" through the earth are familiar sights; however, the entrances to their deeper shafts are unrecognized. Moles push large amounts of earth through the shafts from below. Usually an unkempt, cracked pile of raw earth is the result. The pile generally has the last portion of earth pushed up on one side. This has been formed into a hard cylindrical "plug." Moles more than compensate for the nuisance of their tunnels by eating grubs that eat young plants and by aerating and cultivating the soil. Sometimes they are blamed for eating grass roots, but the mice that enter the tunnels are the real culprits.

Foxes digging for food make a long trench similar to that made by a dog burying a bone. Fox dens have an opening ten to twenty inches in diameter. Remains of prey are usually at or near the opening. If the den is in use, it usually has the "skunky" odor spoken of before. Red fox dens are usually on the sunny slope with a bare bank "lookout pose."

Badgers are champion diggers. Their dens have an elliptical opening about eight-to-twelve inches wide with a large pile of soil. They locate in well-drained open areas.

Woodchuck burrows are about eight inches in diameter with a number of openings. They are usually found near wooded edges of grassy areas. Piles of dirt at the entrance are sometimes present. Other animals, especially foxes, often use abandoned woodchuck dens.

Riverbank homes: Along a riverbank are sometimes found the homes of muskrat or mink. The beaver-like piles of vegetation made by muskrat are easily seen and recognized by almost everyone. However, some muskrat dig into river banks or lakeshores at or below water level. Sometimes openings are back from the water and concealed with vegetation. These bank homes are usually difficult to find. Water conditions seem to make a difference in the muskrat's choice of home types. Where there is a bend in the river, the inside of the curve is usually more shallow and vegetation-filled. On that side, the mound houses are found, while the deeper, swifter side has bank homes. Mink dig well above the waterline. Their openings are about four inches across and have a musty scent.

Banks are likely to have other openings too. A number of small circular openings usually in a line along a soft seam or scattered in sandy banks indicate the presence of a colony of bank swallows. Rough-winged swallows have similar openings, but they are not grouped together. Usually they are in a very unstable substrate near water.

Another bird with a burrow home is the kingfisher. His nest is usually three to four feet from the top of a bank near water. The opening is three to five inches wide, and smaller from top to bottom. A rub or drag mark left by each foot of the bird is sometimes apparent.

Tree dwellings: Many animals use or produce holes in trees. Few of the tree dwellers make the holes in which they live. Openings from decay or weathering are often modified by the animal using them. Any opening is likely to be used. Its size will determine the size range of the animal likely to move in.

Woodpeckers do produce holes. Hairy woodpecker holes tend to have rectangular openings, usually of about one and three-quarters inches wide.

Horizontal rows of shallow holes, usually on the south side of trees with sweet sap, have been made by sapsuckers. While sapsuckers do eat the sap, they also eat the insects attracted to it.

Small mounds: Invertebrate burrows are a study in themselves. Earthworm openings surrounded by castings and "doodle bugs", or ant lions, sand funnels are probably the most commonly seen. Try dropping insects into the openings to see what happens.

Pits made by larva of tiger beetles are interesting too. They are about the diameter of a pencil. Most of the time they are plugged by the earth-colored head of the insect. If the insect is frightened, it goes to the bottom quickly. A stem of grass thrust into the openings will produce a lively tussle. To get the insect though, one must dig it up. The easiest way is to remain very still until suddenly the hole disappears. The insect's head is filling it. At that time a quick blade thrust into the earth at an angle will capture the larva. Mandibles are sharp, so be careful. Take the insect back to class and try to raise a member of one of the most colorful families of beetles.

Some crayfish make "chimneys" of rounded earth pellets up to several inches high. The tunnels generally go down to water level.

Insect tunnels in standing and downed trees can be most interesting. Look for the sawdust-like material at the openings. Many insects bore "egg holes" with ovapositors. When the eggs hatch, the larva tunnel through the wood or between the wood and bark. Many interesting tunnels and egg chambers can be seen beneath the bark. The growth rate of the larva as well as their number can often be determined.

Exercise - STUDY OF MAMMAL SIGNS AND HABITATS

Behavioral Objectives: At the conclusion of these activities, the students should be able to demonstrate their skill in observation in the out of doors by:

1. Locating eight mammal signs
2. Identify at least four mammals on the basis of tracks.
3. Identify at least two mammals on the basis of homes.
4. Locate and identify two mammal runways.
5. Identify at least two mammals on the basis of scat or droppings.
6. Locate and identify at least two mammals on the basis of teeth marks.

Rationale:

I have found this exercise has worked effectively with children ranging from grades fifth through ninth with the greatest amount of success coming from fifth and eighth grades. In order that this exercise work effectively I feel that it is necessary to let the children discover on their own. In order to do this I feel that one should explain where the mammal signs may be found and what specifically to look for and where to look; explain to the children the area to be covered; divide them into teams of not more than three and allow them to cover the area on their own. If they discover some sign that they wish to ask you about allow them to do so, but have available a handbook on mammal habitat and allow them to find the answer to their questions themselves. It is extremely important that the children be permitted to discover for themselves!

Terms:

Burrows: Homes in the ground
Arboreal: Homes high above the ground in trees
Terrestrial: Homes in brush piles, rock crevices, etc.
Aquatic: Homes in the water
Scat: Animal droppings

Procedure:

Observe as many different mammal signs as you can and place them in one of the six following classes: homes, trails, and runways, tracks, scat and droppings, tooth marks, food storage. Homes of mammals will fall into two basic categories: burrows or homes in the ground; and homes above the ground.

Exercises:

Exercise #1 - Burrows

(1) What is its diameter? Emphasize that it is important to know the diameter in order to theorize as to what type of mammal might use that burrow. Example- would it be more likely that a woodchuck or a field mouse would live in a burrow 6" in diameter? (2) Does the burrow have two or more entrances? (3) What other signs do you find near the burrow, if any? If so, describe. Explain that this is extremely important in order to get a more definite identification of the mammal which is using this burrow. (4) Does it appear to be active? (5) Is it on a hillside near the woods or is it in a flat open field? Explain that some mammals prefer to have their homes on a hillside while others prefer the open field.

Exercise #2 - Homes above the ground

These homes are classified as terrestrial, aquatic, or arboreal. Terrestrial would be homes in brush piles, rock crevices, etc. Aquatic would be homes in the water. Arboreal would be homes high above the ground or in trees.

Example: squirrel.

(1) Is the home in a hollow tree, exposed high in a teee, in bushes or plants near the ground? (2) Is it in a brush pile, rock crevice, beneath logs, or under flooring of an old building? (3) Is it above the water or ponds or streams? (4) What does it seem to be made of? (5) Are there any other signs near the home?

FOOD STORES: (1) Where is the food store found? A hollow tree, buried in the ground or elsewhere? (2) What is in the food store? The children should look for nut hulls, twigs possible stored or possibly buried. (3) Are there any other signs near the food store? Tracks, etc.?

Exercise #3 - Trails and Runways

(1) Does it seem to be well used? (2) Describe the surroundings. Can you tell where it is going? Does it appear to be going toward a water hole or toward an open field for feeding? (4) Are there any signs that indicate what mammal might be using the trail or runway?

Exercise #4 - Scat and Droppings

(Don't let this scare you, the teacher. The children thoroughly enjoy this.)

(1) Describe by telling its shape, size. content, etc. Explain to the children that by studying its shape, its size, and its content (Can you see any fur, bones, etc.?) that it is possible to tell almost exactly what animal this came from and exactly what they were feeding on. (2) Draw as well as you can. (3) Collect and place in a plastic bag.

Exercise #5 - Toothmarks

(1) Where are they found? tree trunks? nut hull? elsewhere? (2) Would you say the animal was large or small and why? Explanation: You might find tooth marks in the trunk of a tree where a beaver has been working. You might point out to the children after they had expressed their views that by the height from the ground that these tooth marks were on the tree that this would more than likely be a small mammal. (3) Was that which you found the tooth marks food? If not, what do you think it was used for?

Exercise #6 - Tracks

(1) By using your chart you can identify the tracks. (2) Does there seem to be only one animal of the kind in the area or does there seem to be many? Explain to the children that they need to check for tracks of different sizes and numbers.

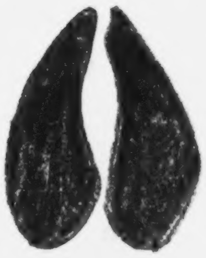
Exercise #6 - Tracks (cont.)

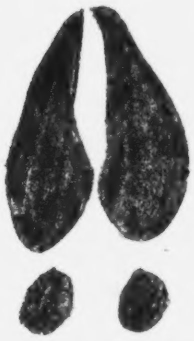
(3) Draw the track. (4) If weather permits, make a plaster print of the track. Explain that they need to select a clear track and remove all debris such as sticks, leaves, etc. from the track being very careful not to destroy the track. Place twigs or cardboard strips around the track. Mix the plaster to a ratio of two parts plaster to one part water or until it is about as thick as pancake batter. Pour plaster into the track and allow to dry. Allow enough time too for the track to harden so plaster will not break when lifting from the earth. Tell children to let the track set over night before they try to clear away the dirt.

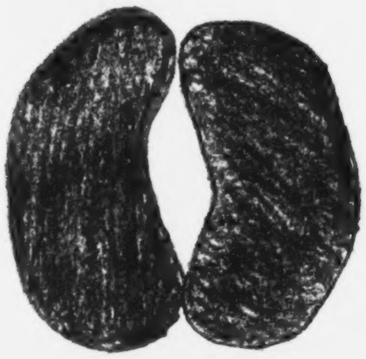
Keith Chapman

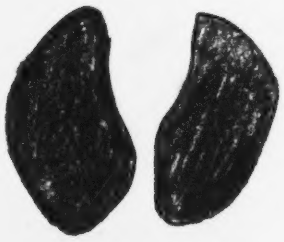
ANIMAL TRACKS

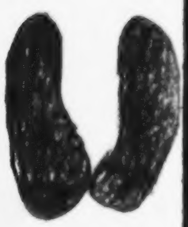
Marks on Left Edge Indicate Inches


Deer
Doe

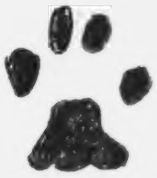

Deer
Buck

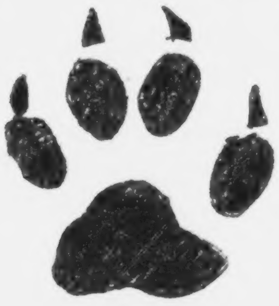

Domestic Cow

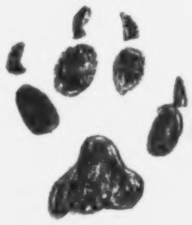

Hog

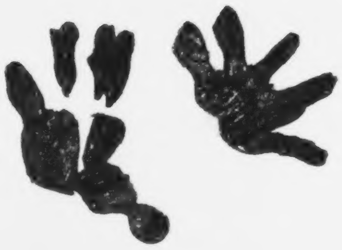

Goat

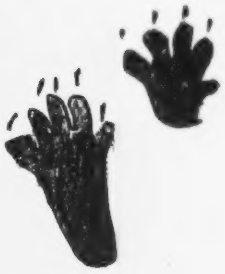
Track and Trail of Leaping Deer showing Dew Claws

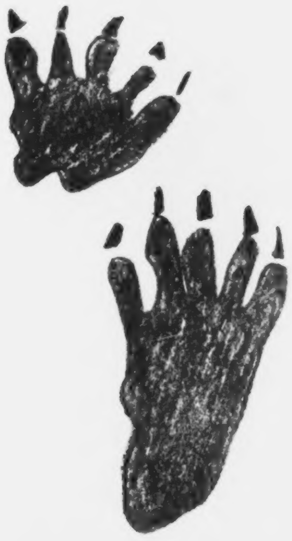

Bobcat

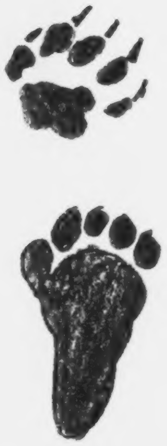

Dog


Gray Fox

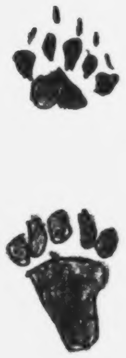

Opossum

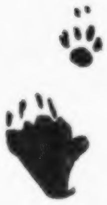

Squirrel


Raccoon

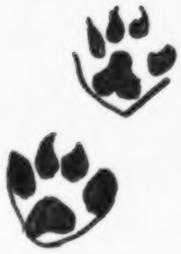

Skunk

Woodchuck

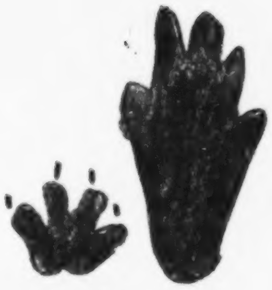

Civet Cat



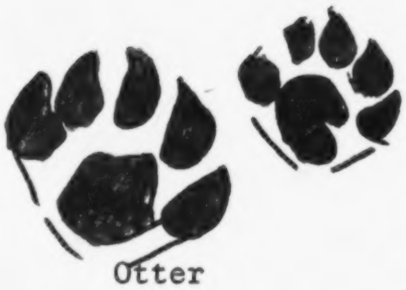
Chipmunk



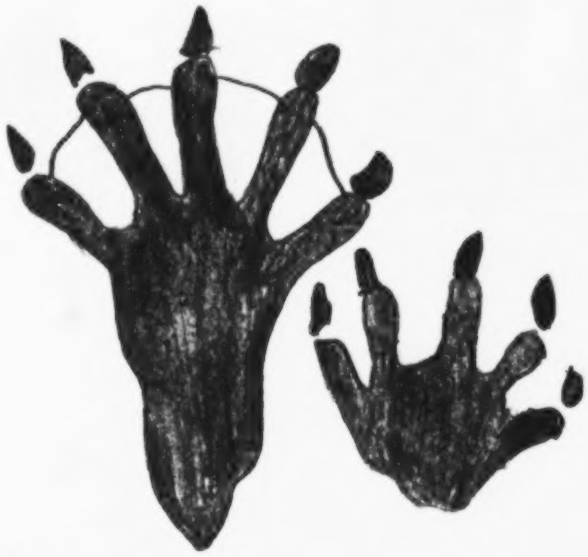
Mink



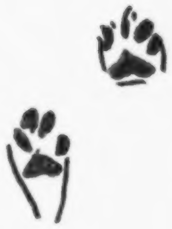
Muskrat



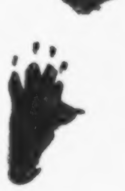
Otter



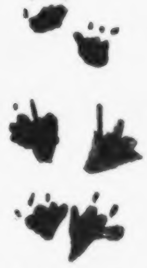
Beaver



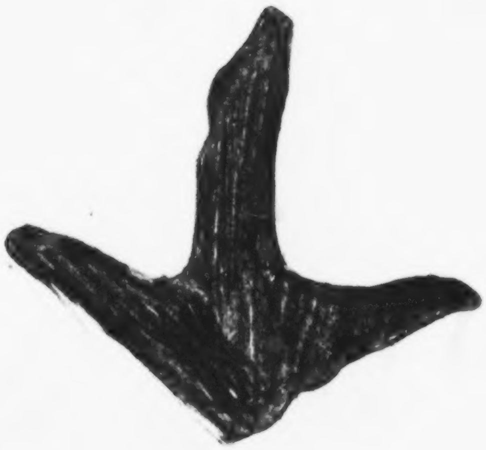
Weasel



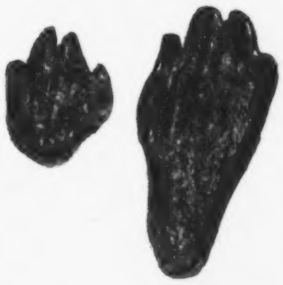
Rat



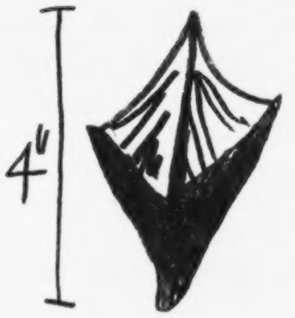
Mouse



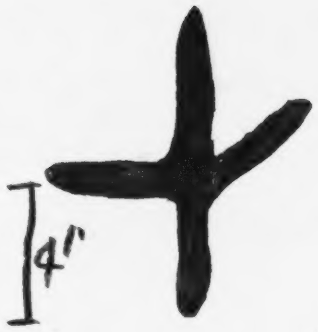
Turkey



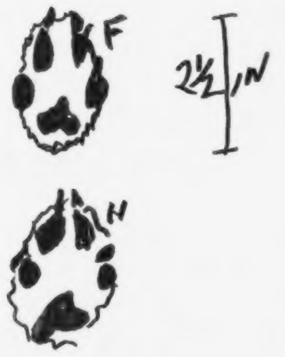
Rabbit



Canada Goose



Heron



Red Fox

Exercise: Nocturnal Activity

Purpose: To determine the period when the largest number of animals and species are active and to determine any correlation between animal activity and abiotic factors of the environment.

Behavioral Objectives: At the conclusion of this observation, the students will be able to state

A. The time period during which the largest number of animals are active.

B. The effect of abiotic factors on activity of animals.

Materials: Sugar lure, aluminum paint, small paint brushes

Appropriate for grades 5, 8, 10.

An important behavioral pattern of any animal species is its time of activity. Many animals are active at night, yet all animals that are nocturnal are not active at the same hours. Some are active early in the morning hours. An appreciation of the interrelationships of animals can be gained by a night's study of the activity of animals in a wood lot.

A trail will be set up by the instructor through a woods containing several stumps or logs. Such a woods would preferably be a climax community, where leaf litter is thick, and animals abundant. Commencing at dusk, the class will cover the trail, stopping at each log or stump to note the kinds and numbers of animals found and their positions on trunks and stumps. Each invertebrate may be marked with a dab of aluminum paint. The trail will be retraced at regular periods throughout the night. As the night wears on, it will be seen that various species appear at certain times and then move up and finally down the trees. Light traps (see p. 91) and sugar lures may also be used and checked at regular intervals to gain an idea of the time of activity of various species. Sugar lures may be prepared with brown sugar and/or molasses, mixed with bananas or crushed apples. The mixture is allowed to age a bit, until slightly fermented when it will produce an attractive odor. It is then brushed on suitable trees along a woodland trail.

When not engaged in observing animals on the trail, the students will make hourly records of wind velocity, relative humidity, evaporation rate and temperature.

From the data gathered, you should be able to determine:

1. the period during which the largest numbers of animals are active
2. the period during which the most species are active
3. any correlation of activity of animals with the time, temperature, humidity, or other physical factors

What advantage might it be for a species to have a genetically determined hour of activity (modifiable by local environmental conditions)?

By: Joe Milam, Rickie Hicks, Shirley Menendez

NOCTURNAL ACTIVITY

DATA SHEET

STUDENT:______________________________ DATE:______________

Location:__________________________ Weather:______________

TOUR I			
Time ______________ Rel. hum., surface ______________ Rel. hum., 3 ft. ______________	Air temp., surface ______ Air temp., 3 ft. ______ Wind velocity ______		
Species	Quant.	Habitat	Distance from ground

NOTE: As many tours as desired may be set up and conducted.

EXERCISE: SOCIAL STUDIES - Cemetery

Behavioral Objectives:

Following this exercise the student should be able to:

1. Identify graves of persons over five years old dying before 1900.

2. Identify graves of persons over five years old dying after 1920.

3. Name data such as birth date, death date, age, and wars represented in the cemetery, different countries represented, interesting epitaphs, and work space, different materials used in making gravestones.

4. Interpreting data about average ages found on gravestones.

Materials: pencil, paper, list of questions

I. Activity: Go to a graveyard and answer the following questions:

1. For five graves of persons over five years old dying before 1900, list birth dates, death date, age, work space, and average death age for the five persons.

2. For five graves of persons over five years old, dying after 1900, list birth date, death date, age, work space, and average death age for the five persons.

3. Record three interesting epitaphs.

4. List different wars represented in this century.

5. List different materials found in making gravestones.

6. List different countries represented.

7. Interpret the information found in answering question 1 and 2 to draw some conclusions about the differences in average death ages.

Jane McCool

SOCIAL STUDIES

EXERCISE: Old Homesites

PURPOSE: To learn something of the homes and daily life of the people who lived in this section of Kentucky in the middle and late 1800's.

BEHAVIORAL OBJECTIVES:

After this exercise is concluded, the student should be able to:

1. Recognize different kinds of locations for homes.
2. Identify materials used in the early homes of this region.
3. Have some idea of how the people made their living.
4. Know something of their communication with each other and the outside world.

MATERIALS: Notebook and pencil for note taking, compass and worksheet.

PROCEDURE: Go to at least three or four different homesteads.

ACTIVITY 1. Observe location

1. Is it located on a hill?
2. Is it in a valley?
3. Is there any source of water nearby?
4. Is this home near others?
5. Is the location in a wooded place?

ACTIVITY 2. What materials were used in the buildings?

1. Wood?
2. Brick?
3. Rock?
4. Dirt?
5. Glass?
6. Nails?

ACTIVITY #3. Observe any evidence of how these people made a living.

1. Does the land appear flat or hilly?
2. Does the land seem fertile?
3. Do any fences that might have been used with cattle still remain?
4. Is the river near enough to be used in making a living?
5. Are there many barns?
6. Is the home near enough to the iron mines for someone to go to work there?

ACTIVITY 4. Consider the daily life of the people.

1. Is the home in or near a town?
2. How did they communicate with others?
3. How did they get their mail, clothes and other supplies?
4. How many rooms does the house have?
5. What bath or toilet facilities can be seen?
6. How was the house heated?
7. Does the house seem to have ever been painted?
8. Do you find any trees, shrubs, grass, or flowers that were planted by a person?

Jessie Huie

EXERCISE - Observation visit to the farm

Behavioral Objectives:

At the conclusion of this exercise, the student should be able to:

1. Identify and name the various animals observed on the farm.
2. Describe uses of the various animals on the farm.
3. Name the various crops observed on the farm.

Materials: Notebook and pencil for taking notes.

Activity: Visit all the barns, pastures, fields, pens, and exhibits.

Questions:

1. How many kinds of rabbits did you see?
2. Why do farmers raise sheep?
3. What does the mule do for the farmer?
   (Other similar questions pertaining to the animals and crops on the farm)
4. What evidence did you find of birds living in the barns?
5. What kind of birds live in the barns?

Jane McBride

EXERCISE: TEST FOR SOLID PARTICLES IN WATER

Purpose: To show the amount of solid particles in various sources of water.

Equipment and materials: Thermometer, 3 100 ml graduated cylinders per student group

Procedure: Find 3 different sources of water and record color, temperature, and velocity as fast, moderate, or slow

Select 3 water samples from 3 different sources and measure 100 ml of each sample in a 100 ml graduated cylinder. Allow to stand for 24 hours and by using the units of measurement on the container, record the amount of sediment per sample.

Questions:

1. Which of the three samples has the most sediment?
2. Does a fast moving stream have more sediment than a slow moving stream?
3. Does warm H_2O have more solid particles than cold H_2O?

Joe Milam
Rickie Hicks
Shirley Menendez

Exercise: Free Carbon Dioxide Concentration in Water

Purpose: To determine Free CO_2 Concentration

Obtain a water sample and with it fill a Nessler tube to the 100 cc mark. Be careful not to splash or agitate the water, since carbon dioxide will easily come out of solution. Proceed immediately to analyze the sample as follows:

1. Put in 10 drops of phenolthalein solution. (5 g. phenolthalein in 1 liter of 50% alcohol, neutralized with N/50 NaOH)
2. Titrate with N/44 NaOH. Be sure to write down the level of NaOH before starting the titration.
3. The end point is reached when a pink color appears for a few seconds under agitation. Do not titrate until a permanent pink color forms.
4. Read the burette after titration, calculate the amount of NaOH used.
5. Multiply this amount by 10. This will give the amount of free CO_2 in parts per million that was in the sample.

Appropriate for grade 10.

Joe Milam
Rickie Hicks
Shirley Menendez

Exercise: OXYGEN CONCENTRATION IN WATER

Purpose: To determine the Oxygen concentration in water

Glass bottles with tight-fitting glass stoppers and having a capacity of 250 cc. are used. Make certain all glassware used is clean. Special water samplers are available to secure water without introducing atmospheric oxygen. If a sampler is not available, the water should be obtained in such a manner as to avoid splashing or bubbling the water. Siphons are often of use in such a procedure. Temperature of the water should also be recorded at the time and place the water is collected. If water is then transferred from the sampler to the bottle, the water should be allowed to overflow the 250 cc. bottle 2-3 times to flush out atmospheric oxygen. When the stopper is replaced, no air bubble should remain.

Now proceed to analyze the water as follows: (This is known as the Rideal-Stewart modified Winkler test.) For steps 1-6 the reagents should be added quickly and the bottle restoppered to prevent oxygenation from the atmosphere.

1. To water sample add:
   a glass bead to aid in mixing
   .7 cc. concentrated H_2SO_4
   1.0 cc. $KMnO_4$ solution

2. Shake well. A pale violet to pink color should appear and persist. If it does not, add another cc. of $KMnO_4$ solution. After the color is established, allow the sample to stand for at least 40 minutes.

3. Add 1.0 cc. potassium oxalate solution. Let stand until the color disappears.

4. Add: 1.0 cc. manganous sulfate solution
   3.0 cc. hydroxide sodium iodide solution

5. Shake. A yellow precipitate will form. Allow this to partially settle and then shake again.

6. Add .5 cc. of concentrated H_2sO_4. The precipitate should dissolve. If it does not add another .5 cc. of the acid. The yellowish color remaining represents the iodine which has replaced the dissolved oxygen. At this point analysis may be suspended for some time, allowing the titration to be carried out in the laboratory.

7. Measure out 100 cc. of the water sample and titrate with the sodium thiosulfate solution. MAKE SURE YOU READ THE LEVEL OF THE SODIUM THIOSULFATE SOLUTION BEFORE YOU START TITRATING. WRITE IT DOWN. Titrate until a very pale yellow color is reached.

8. Add 2 cc. of starch solution. The sample will turn blue.

9. Continue titrating until the sample becomes clear. The clearness should persist under agitation.

10. Calculate the amount of sodium thiosulfate used, in cc., and multiply by 4/5. This will give roughly the parts per million of dissolved oxygen in the sample of water. More exactly, PPM dissolved O_2 =

$$\frac{800 \times \text{cc. thiosulfate used} \times \text{normality of thiosulfate}}{\text{cc. of sample titrated}}$$

Reagents.

All water used should be distilled. Salts usually dissolved in small quantities of water first, then diluted.

Potassium permanganate solution: 6.32 gm. $KMno_4$ in 1 liter H_2O.
Potassium oxalate solution: 20 gm. $K_2C_2O_4 \cdot H_2O$ dissolved in water.
Add 4 grams of NaOH and dilute to 1 liter with water.
Mangagous sulfate solution: 480 grams $MnSO_4 \cdot 4 H_2O$ to 1 liter of water.
Hydroxide-sodium iodide solution: 500 gm. NaOH and 135 gm. NaI to 1 liter of water.
Sodium thiosulfate: (N/10): 24.82 gm. NaS_2SO37. 5 H_2O to 1 liter of water. Use cooled boiled water. Add 5 cc. of chloroform. When this is to be used, dilute to n/100 by adding 9 parts water to 1 part of this solution.
Starch solution: 3 gm. potato starch, ground with H_2O. Place in 500 cc. freshly boiled water. Allow to stand overnight then use only the cleat fluid.

Appropriate for grade 10

Joe Milam
Rickie Hicks
Shirley Menendez

Exercise: White-Disc Test For Water Pollution

Purpose: To show visible signs of pollution by particles and discoloration in various bodies of water in the area.

Behavioral Objectives:

1. Be able to identify possible signs of water pollution.
2. Compare the discoloration of water in same general area.

Materials: White-disc connected with long stick which is marked off in units of length

Procedure: While holding the disc apparatus by the stick, push it down into water until the disc is no longer visible. Take a reading on the graduated stick and record. After repeating this in several places, make comparisons of visibility of water bodies. Also make comparisons of different areas in same pond or lake.

Appropriate for grades 5, 8, 10.

Joe Milam
Rickie Hicks
Shirley Menendez

Exercise: Temperature Conversion

Purpose: To develop skills in converting Fahrenheit temperature readings to Celsius and vice versa.

Behavioral Objectives: At the conclusion of this investigation the students will be able to calculate temperature conversions.

Go to a pond. Take the Fahrenheit temperature in the shade and in the light. Convert those temperatures to Celsius readings.

Go to another water source and take the Celsius temperature reading. Convert that temperature to Fahrenheit.

Take the temperature at your dormitory in the morning, noon, and in the evening. Convert those Fahrenheit temperatures to Celsius.

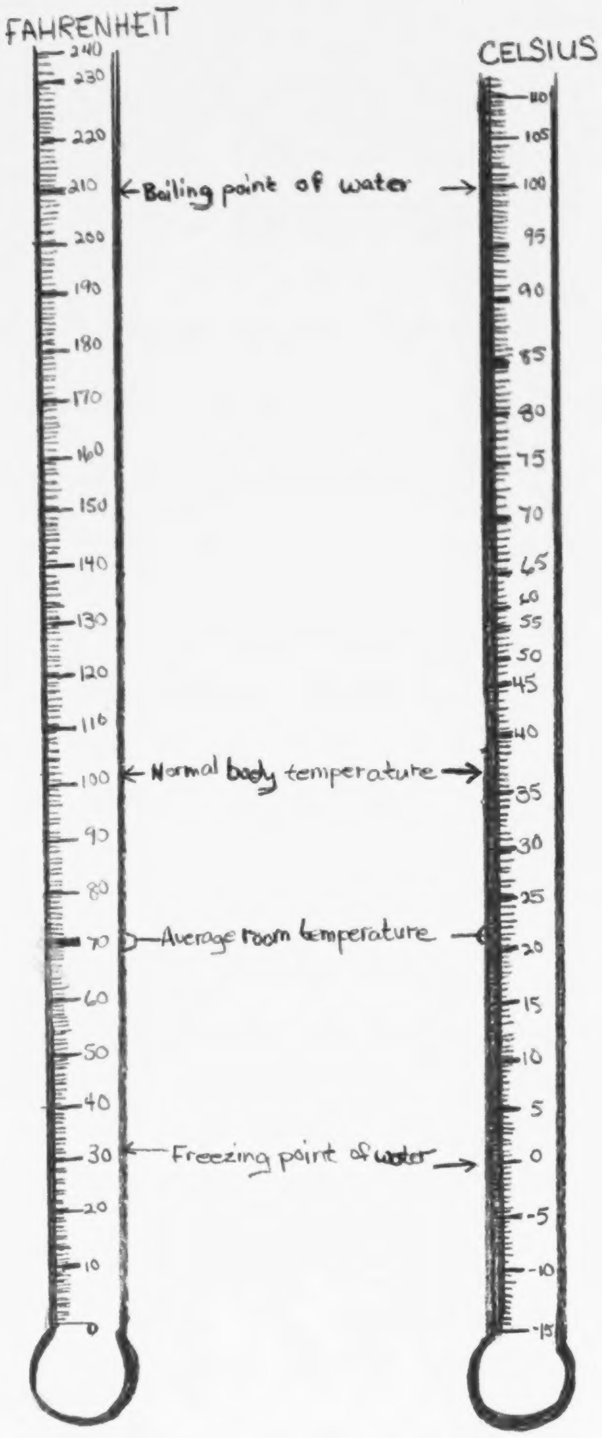
Joe Milam
Shirley Menendez
Rickie Hicks

Appropriate for grades 5, 8, 10.

TEMPERATURE CONVERSION

It is not difficult to convert temperatures from one scale to the other if you remember the following. A Fahrenheit degree is only 5/9 of a Celsius degree, and $32^{\circ}F$ $=0^{\circ}C$ (the freezing point of water). If you know the temperature in Fahrenheit degrees, and wish to change to Celsius, you first subtract 32 from the Fahrenheit temperature and take 5/9 of the remainder. To convert from Celsius degrees to Fahrenheit, you reverse the process: Multiply the Celsius temperature by 9/5 and add 32.

The chart on this page can be used to convert temperature quickly by reading across from one scale to the other.


FAHRENHEIT
CELSIUS
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
Boiling point of water
Normal body temperature
Average room temperature
Freezing point of water

Exercise: Life and Oxygen Concentration

Purposes: To determine O_2 concentration in different environments and to determine the effect various oxygen concentrations have on fish, crayfish, or any aquatic animal.

Behavioral Objectives: At the conclusion of this inquiry the student will be able to (1) recognize aquatic producers of oxygen.

(2) determine the concentration of oxygen that is required by aquatic animals.

Materials: 3 glass gallon jars, 2 aquatic plants, black tape, 3 similar aquatic animals

Procedure: Take the three gallon jars. Fill them with water from the same source. Measure the oxygen concentration in each container. Cover the #1 gallon jar with black tape. Place a plant in it. In the #2 container, place an identical plant to the one you used in container #1. Water will be the only item in container #3. Place all 3 containers in the sun. After the containers have been in the sun for 6-12 hours, measure the oxygen concentration in each container.

Why does the concentration vary?

Which container has the most concentration of oxygen? Why?

Which container has the least concentration of oxygen? Why?

Put one of the three similar aquatic animals in each container. Observe them for 30 minutes. Record your observations. Explain the reactions in each container.

Joe Milam
Rickie Hicks
Shirley Menendez

EXERCISE: HYDROGEN ION CONCENTRATION

Purpose: This investigation uses a method by which acidity--alkalinity of H_2O in soil can be measured.

Behavioral Objectives: At the conclusion of the investigation the student will be able to A. Identify pH of soil and H_2O and B. Contrast pH of various sources.

Materials:
- pH paper
- distilled H_2O
- small jars with lids

An approximate value of hydrogen ion concentration of water, expressed in pH, may be obtained by using special indicator papers. These papers are merely dipped in the water, and the resultant color is compared to a color standard. For testing soil pH, a small sample of soil may be placed in 5 cc. of distilled water and shaken well. Allow the mixture to settle and then use the indicator paper. The soil should be tested at ground level and then in the sub-surface. This type of test is not precise, and gives only an indication of the pH of soil or water. It may be quite inaccurate under certain circumstances, such as in highly organic soils.

Go to three different sources of water and test the pH. Suggested places could be (a) the lake, (b) pond with plant life, (c) pond without plant life, and (d) brook. Record the results.

Collect at least three different soil samples. Suggested sources of soil could be (a) from the edge of the woods, (b) inside the woods, (c) shoreline, and (d) open field.

With a large enough series of indicators, the approximate pH of solutions can be worked out. Often it is more convenient to use indicator paper than a pigment solution. Indicator paper is prepared by soaking porous paper in a pigment solution and then allowing it to dry. A number of pigments may be combined in the same paper so that different ones do not have to be tried separately. This part of the investigation makes use of such an indicator paper.

Obtain soil samples from different environments. Place about 10 g of soil in a mortar, add 10 ml of distilled water, and grind. Pour the mixture into a test tube labeled with the name or number of the soil sample. Wash the mortar and pestle and rinse with distilled water before preparing the next sample. Repeat this procedure for each sample prepared. Permit the tubes to stand for ten minutes.

Place one microscope slide in front of each test tube. a small piece of test paper on each slide. Dip a glass stirring rod into the first sample and transfer a drop of the liquid to the test paper. Note the color of the test paper where the drop has been placed and compare it with the color scale that comes with the paper. Record the pH of the sample. Repeat this procedure for each sample, using a different stirring rod and slide in each case.

Summary:

What is the pH range of your samples?

According to your evidence, what types of soils are most likely to be acid?

Which are most likely to be alkaline?

Which are most likely to be neutral?

Suggest some reasons for the differences or similarities in pH.

This method provides a comparison of the pH of the samples, but does not give the true pH. Why?

ENVIRONMENTAL EDUCATION ACTIVITIES

Exercise: Water Study

Purpose: To determine the hard/soft nature of water by measuring mineral content of samples with liquid soap.

Behavioral Objectives: After completing this activity a person should be able to:

1. Test water samples from unknown sources and determine the degree of hardness/softness by using liquid soap.
2. Justify answers to questions on water study sheet.

Materials: Sample bottles with covers; liquid soap; metric ruler; hand pipette; time piece.

Procedure: Each team of 2 students are to collect water samples from 4 different sources.

Measure 1 cm. of water in sample bottle.

Add 1 drop of liquid soap to sample and shake vigorously for 30 seconds. Wait 30 seconds. Measure suds layer and record results on data chart

Sample	Sample Source	Number of Soap Drops	Thickness of Suds cm.			Soft/Hard (Deg. of Hardness
			Trial 1 -	Trial 2-	Avg.	

Number of Drops	Hardness
0-5	Very soft
5-10	Medium
10-15	Very Hard

1. What makes water hard?
2. What prevents soap from sudsing in hard water?
3. Why does it cost more to wash with hard water than with soft?
4. How can hard water become softened?
5. What effect would hard water have on the water pipes of your home?

Charles A. Cissell

ENVIRONMENTAL EDUCATION ACTIVITIES

EXERCISE: Soil Study

Purpose: To sample soil in four different environments in order to determine the significance of color, texture, temperature, moisture content, and acid/alkaline chemical nature.

Behavioral Objectives: After completing this activity a person should be able to:

1. recognize and identify the three principal components of soil.
2. distinguish between plant material (organic matter) present in soil and mineral material (inorganic matter) present in soil samples taken from unknown sources.
3. record the pH value of any soil sample to accuracy of .5 of a point.
4. to satisfactorily support answers to guide questions on soil study activity sheet.

Materials: Chemical soil test kit; spoon; knife; metric ruler; hand lens; soil thermometer.

Procedure: Each team of 2 students are to choose one of 4 environments for test sampling--

1. Open field
2. Edge of Woods
3. Interior of woods
4. Near edge of water.

Measure temperature of the air and compare with the soil temperature.

Use spoon and knife to dig 20 cm. down into soil in three sample areas of the environment selected. If litter is present over the sample area, expose the soil surface before starting to work.

Examine or test soil sample at each 5 cm. level of depth in the three sample holes and record information requested on the data sheet.

Answer questions on the activity sheet.

ENVIRONMENTAL EDUCATION ACTIVITIES

SOIL STUDY DATA SHEET

Environment of Sample		Sample 1	Sample 2	Sample 3	Average
Soil Color					
Soil Texture					
Moisture of Soil					
Soil pH	0 cm.				
	5 cm.				
	10 cm.				
	15 cm.				
	20 cm.				
Soil Condition					
Air Temperature					
Soil Temperature					

KEY

COLOR	TEXTURE	MOISTURE	CONDITION
Very Dark	Gravel	Dry	Rich
Dark	Sand	Moist	Poor
Light	Silt	Wet	Eroded
Very Light			

Charles A. Cissell

ACTIVITY SHEET

ENVIRONMENTAL EDUCATION ACTIVITIES

SOIL STUDY

Purpose: To sample soil in 4 different physical environments in order to determine the significance of color, texture, temperature, moisture content, and acid/alkaline chemical nature.

Work in teams of two for this exercise. Your teacher will permit you to choose an area of study.

RECORD THE INFORMATION REQUESTED ON THE DATA CHART AS ACCURATELY AS POSSIBLE.

If litter (grass, leaves, twigs) covers the soil surface, remove it before you begin to work. Choose three sample areas and dig a hole 20 cm. down in the soil.

Examine a soil sample at each 5 cm. depth carefully with the hand lens. What is the soil composed of?

Is topsoil present?

How deep is it?

Can you identify plant material from mineral material? How?

Hold a small sample of soil near you ear and rub it between your fingers. Can you identify particles of sand, silt, and clay?

Describe the appearance of each. (Use hand lens)

Sqeeze soil samples together in your hand. Do they form a ball? What does this indicate to you concerning moisture content?

Follow the instructions in the soil test kit and determine the chemical nature of the soil (acid/alkaline or base) at each 5 cm. depth of the three sample areas. (Do not touch the soil test equipment with your hands or the soil sample you plan to test. Why is this important?)

How is soil formed?

How does the forces of nature help to produce soil?

Check the containers each day and after three days collect the containers and place the tops on each one. Take the containers back to the lab and do the following exercises.

A. By using the formula for finding the area of a circle, calculate the number of particulates in each container per unit area. Do this by figuring the area of the top of each container. ($A = \pi r^2$)

B. If the amount of particulate is sufficient, weigh it and calculate the weight per unit volume.

C. Which color of material (particulate seems to be the most dominant?) (Use your hand lens)

D. If rain occurs during your experiment. let the H_2O evaporate before trying to remove the particulates.

Joe Milam
Rickie Hicks
Shirley Menendez

EXERCISE: PARTICULATE FACTOR

Purpose: To collect and measure the amount of solid material in a given volume of air.

Materials: (per collection station)

1. three wire coat hangers
2. one gallon size plastic containers with lids (ice cream bucket may be used)
3. masking tape
4. one petri dish
5. three wire hooks
6. three 12 inch wooden stakes
7. heavy gauge string
8. scales (optional)
9. wire pliers
10. three sheets of white paper
11. scissors
12. hand lens

Procedure: Distribute five plastic containers approximately 500 feet apart along a trail. Remove the lid from each and in the bottom of each container place a white paper disc that completely covers the bottom of the container. Secure the containers by using the following method.

If the containers are placed on the ground, place 3 stakes around each and drive the stakes 6 to 8 inches in the ground leaving about 6 inches of the stake above ground. By using wire pliers construct 3 wire hooks with a loop in one end of the hook. Place the hooks over the edge of the plastic container. Tie one end of a heavy gauge string to the loop of the wire hook and pull the hook snug over the side of the container. Now tie the other end of the string to the wooden stake. Do this with all three hooks and the container should be tightly secured.

By using three wire coathangers, construct a ringstand above the container to keep birds from sitting on the top of the container. Tape the straightened hook of the coat hanger to a stake to secure it. It will also help if you tape the ring section of the three coat hangers together.

EXERCISE: A Stream Valley

Behavioral Objectives: Following this exercise, the student should be able to:

1. Describe the three distinct cycles which a stream valley goes through from birth until destruction to birth again.
2. Plot the course of the channel of the stream being investigated.
3. Identify the land and water formations which occur in a stream valley.

Information:

The purpose of the field trip is to observe a landscape created by the interactions of atmospheric and geologic processes. The value of field observation lies in the removal of the abstract nature of classroom work and the presentation of concepts in their actual environment.

______________Valley, our destination, is the results of three processes, erosion, transportation of the eroded materials, and deposition of these materials. Running water is the main force which creates this type of topography. Most of the water which falls in the form of rain or snow flows over the land as runoff. This running water, on its way to a larger body of water, exerts an enormous force toward changing the features of the surface of the surrounding landscape. It wears away hills and moutains. erodes valley, removes the loose material produced by weathering, and deposits all the material removed on other parts of the land.

In the cycle of erosion a stream may go through three distinct stages; Youth during which the erosive action is largely downward and the stream is characterized by a steep gradient, a deep, narrow, V-shaped valley, falls and rapids. Maturity, characterized by a wider, U-shaped valley, both depositional and erosive action, and absence of falls and rapids, development of a flood plain, and a beginning of meanders; and old age where lateral cutting dominates process of erosion more nearly balanced. shallow gradient, moderate stream velocity, broad, flat floodplain, V-shaped valley and immature oxbows.

Activities: Your Stream and Valley Study

Answer these questions in the field or in the classroom after your trip.

(a) Measure the width of the stream at the mouth and at various points as you move up stream.

(b) Measure the depth of stream at mouth and at various points upstream.

(c) Measure the velocity of stream if possible.

(d) Which direction does the stream flow?

(e) Measure the temperature of water in the stream and the air above stream.

(1) Water Temperature ____________
(2) Air Temperature ____________
(3) Total Difference ____________

Exercise: A Stream Valley (cont.)

(f) List items which might influence the channel of the stream to cause it to meander.

(g) Identify landforms which have been constructed by the meandering stream.

(h) State whether the cutting action of the stream load is on the inside or outside of the bend. Where is deposition occuring in the stream bed?

(i) Does the stream utilize turbulent flow or laminar flow in its movement? Illustrate both types in drawings.

(j) Have you found any signs of oxbows being developed or in existence at present? Draw the stages of the development of an oxbow.

(k) In an ideal situation which do you think would reach maturity sooner, a stream in a shale area, or one in a sandstone region? Explain why you selected either a shale area or a sandstone area.

(l) Which do you think would reach maturity sooner, a stream in a dry climate or one in a humid region? Why?

(m) List characteristics of a stream using three stages.

TYPES	YOUTH	MATURITY	OLD AGE
Gradient			
Velocity			
Material Carried			
Deposition by stream			
Shape of valley			
Trend of stream			

Exercise: A Stream Valley (cont.)

(n) Construct a paragraph using these words in the correct sequence to illustrate the changing of a mountainous region to a peneplane.

(1) V-shaped Valley
(2) U-shaped Valley
(3) Flat-shaped Surface
(4) Tributaries
(5) Gradient
(6) Base Level
(7) Turbulent Flow
(8) Laminar Flow
(9) Meanders
(10) Oxbows
(11) Delta
(12) Downcutting
(13) Side cutting
(14) Rapids & Waterfalls
(15) Sandbars
(16) Moderate Velocity

(o) State whether this educational fieldtrip has been beneficial or not to you.

Robert E. Farmer

STREAM VALLEY

Title: Investigating, Weathering and Erosion.

Behavioral Objectives: The student should be able to:
(1) To describe how weathering and erosion have affected the stream area.
(2) To determine the gelolgic age of a stream after studying its characteristics.

Purpose: To recognize some of the evidence and effects of weathering and erosion in the Geology Station and/or Geologic Stream Areas. Make separate lists for each area.

Procedure: Look for rocks or landforms which show evidence of weathering.

Describe each feature clearly and tell whether you think that this is an example of Physical or Chemical Weathering. What do you think has caused the weathering in each case?

Remember: Physical Weathering may be caused by (1) Temperature (2) Frost Action (3) Action of plants (4) Action of animals (5) Abrasive action of wind, water, and ice.
Chemical Weathering may be caused by (1) Oxidation (2) Carbonation (3) Hydration

Activities along stream
PART: A

I. Would you say that the cutting action of the stream is on the inside or outside of the curves? Why?

II. Is the stream fed by many tributaries or only a few?

III. Determine whether the stream is in Youth, Maturity, or Old Age. Explain in detail why you think it is in this age.

IV. Where do you notice deposition along the stream? Why does deposition occur here?

PART: B
Procedure: Look for evidences of Erosion. Describe each area where erosional action has taken place and identify any landforms or surface features that were formed due to erosion. What are the erosional agents in each case? (wind, water, ice, or directly by gravity) Land form examples (gully, talus slope, soil creep, oxbow lakes, sandbars, etc.)

EVIDENCE OF WEATHERING AT THE GEOLOGIC STREAM

Evidence of Weathering	Type	Cause	Erosional Landform	Cause	Sketch and/or Description

GRAPH OF MEASUREMENTS FOR GEOLOGIC STREAM

INTERVALS

Width	Depth	Velocity	Cause at Meander	Air Temp.	Soil Temp.	Water Temp.	Laminar or Turbulent	Direction of Flow	Other

Dale Trentham

GEOLOGIC STREAM AREA

One group will be responsible for sketching the stream and surrounding landforms as we proceed along the stream. Each member of this group later.

This will leave 4 groups of about 6 members per group.

(1) Two members will collect the data needed for the Weathering and Erosion Exercise which follows.

(2) Two members will collect the data on stream measurements.

(3) Two members will record the measurements in chart form.

All members of each group must work together and share the information collected at a later time.

The group sketching the stream will get the information from members of some other group.

NOTE: An interval of every 3 or 4 turns or meanders might be suitable.

I. Title: Investigating Weathering and Erosion.

Purpose: To recognize some of the evidence and effects of weathering and erosion in the Geologic Stream Area.

Behavioral Objectives: Following this exercise, the student should be able to:

1. Identify the erosional and depositional features found along the stream.
2. Describe the stream according to its physical characteristics.

MATERIAL: Notepad, thermometers, tape measure (string), measuring stick, compass.

Procedure: Look for rocks or landforms which show evidence of weathering.

Describe each feature clearly and tell whether you think that this is an example of Physical or Chemical Weathering. What do you think has caused the weathering in each case?

Remember: Physical Weathering may be caused by (1) Temperature (2) Frost Action (3) Action of plant (4) Action of animals (5) Abrasive action of wind, water, and ice.
Chemical Weathering may be caused by (1) Oxidation (2) Carbonation (3) Hydration

EVIDENCE OF WEATHERING IN THE GEOLOGIC STREAM AREA.

Evidence of Weathering	Type	Cause

III. Weathering and Erosion (cont.)

Part B: Procedure: Look for evidences of Erosion. Describe each area where erosional action has taken place and identify any landforms or surface features that were formed due to erosion. What are the erosional agents in each case? (wind, water, ice, or directly by gravity) Land form examples (gully, talus slope, soil creep, oxbow lakes, sandbars, etc.)

Evidence of Erosion at the Geologic Stream.

Depositional or Erosional Landform	Cause

Activities Along Stream

1. Would you say that the cutting action of the stream is on the inside or outside of the curves? Why?

2. Is the stream fed by many tributaries or only a few?

3. Where do you notice deposition along the stream? Why does deposition occur here?

4. Determine whether the stream is in Youth, Maturity, or Old Age. Explain in detail why you think it is in this age.

	Width	Depth	Velocity	Cause of Meander	Air Temp.	Soil Temp.
INTERVALS						

	Water Temp.	Laminar Turbulent	Direction	Other
INTERVALS				

Exercise: Running Water

Behavioral Objectives. At the conclusion of this exercise the student should be able to:

1. Tell the effect of the surrounding land will have on the rate of flow of a stream.
2. Calculate the rate of flow of a stream of water.
3. Calculate the volume of water flow in a stream.
4. Identify theportions of a stream where the current flows the fastest.

Materials: A yardstick or a stick marked in some units of length a watch with a sweep second hand, pencil and note pad or clip board.

Procedure: There will be special kinds of plants and animals in this community which are closely related to the non-living elements to be found here. Each has a certain place to live and a certain job to do in the community. If the places aren't there and the jobs aren't done the community can't exist. A change of any one thing causes other changes, too. Some changes lead to better communities, some to poorer ones. What is going on here?

How does the land around this running water community affect it?

Is it steep or flat?________________________________

How would this affect the water?____________________________

____

How fast is the water flowing?

You can find out this way. Measure a distance along the stream. Throw a stick in the water at the upstream mark. Count the number of seconds the stick takes to reach the end of the distance you marked.

The stick goes____________feet in____________seconds.

Divide the number of feet traveled by the number of seconds to find the rate of flow each second_______________________.

Was this at the edge of the stream or in the middle?____________.

Would the rate be the same in another location along this stream?

Try the same experiment there __________ feet in __________ seconds.

Which was the faster rate? ______________________________

Why do you think this was the case? ______________________________

Do you think this stream of water would always flow at this same rate?

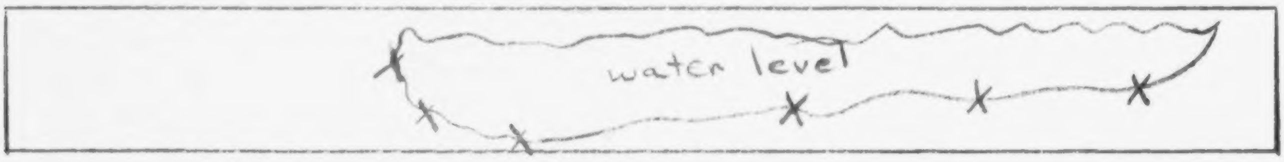
__________ At what times could it be different? ______________

____

What could cause the rate to change? ______________________________

____

How deep is this stream? IF THE STREAM IS SMALL, take a yardstick and wade in a straight line across it Measure the depth in several places as you go. Draw a diagram of your measurements below.



Connect the points measured with a line to show the bottom profile.

Where was the water moving most rapidly? ______________________________

Why do you think this was so? ______________________________

____

Add your measurements together and divide by the number taken to find

the average depth ______________________________

If this was in inches, divide by 12 to change it to feet. __________

Activity: What is the volume of water flowing in this stream?

Multiply the average depth ____________________

by the average width ____________________

Multiply this answer by the
feet traveled per second ____________________

to get the volume of water ____________________ DISCHARGED IN CUBIC FEET

IF THE STREAM IS TOO LARGE TO WADE, a long pole with a weighted line at the end can be used. Mark the line with red tape at foot intervals. The line may be dropped into the water and provide some information concerning the depths in various locations across the stream. (Bamboo rug poles are lightweight and a good length.)

Anonymous

EXERCISE: The Geology Station (LBL)

Behavioral Objectives: Following this exercise, the student should be able to:

1. Identify mineral differences as to color, shape, composition, weight and texture.
2. Order rocks according to color, shape, composition, weight and texture.
3. Point out fossils in the area.

Activities:

I. Observe as many different types of rocks from three (3) levels down the slope of the pit and group them according to the following outline:

   A. Color
   B. Color Streaks
   C. Shape
   D. Composition
      1. All one material
      2. Mixtures
   E. Textures
      1. Rough
      2. Smooth
      3. Jagged
   F. How formed?
      1. Water Formed
      2. Fire Formed
      3. Total Change

II. Describe the difference between the weathered surface of a rock and freshly broken surface.

III. Test rocks for hardness. Describe how you tested them and what your results were.

IV. In your search for different group of rocks, have you uncovered a rock which is rounded, hollow, and contains crystals on the inside, if so, what is the rock called, how are they formed, what minerals generally compose the outside covering and state color and type of mineral makeup of the crystals on the inside.

Exercise: The Geology Station (cont.)

V. Make a map of this area showing rocks and minerals found here according to your own classification system.

Ideas: Location, direction (NSEW), height from top level, areas of folding.

VI. Note types of fossils. Draw what you see and identify back in the classroom.

VII. Decide whether this area was created by man's influence or by nature's influence. List items to support your choice.

VIII. What has been the most effective tool of nature in the erosion of this area? Wind? Water? Glaciers? Man? Fire?

IX. State evidences of:

Physical Weathering
(a) Frost wedging
(b) Exfoliation
(c) Leaching

Chemical Weathering
(a) Carbonation
(b) Oxidation
(c) Hydration

Robert E. Farmer

GEOLOGY STATION

TITLE: INVESTIGATING ROCKS AND MINERALS

Purpose: To find out how rocks and minerals differ

Behavioral Objectives: Following this exercise the student should be able to:

1. Describe a rock according to its physical properties.

2. Identify a geode.

3. Identify fossils common to this area.

4. Distinguish between weathered and unweathered rocks.

PROCEDURE:

Part A. I. Find as many different rocks as you can from 3 different levels down the slope of the pit. Describe them as clearly as you can. Your description should include such things as:

- A. Color
- B. Shape
- C. Composition
  - 1. All one mineral
  - 2. Mixture
- D. Weight
  - 1. Heavy for size
  - 2. Light for size
- E. Texture
  - 1. Rough
  - 2. Smooth
  - 3. Jagged
- F. Genetic Class
  - 1. Igneous (fire-formed)
  - 2. Sedimentary (water-formed)
  - 3. Metamorphic (changed)

COLOR	SHAPE	COMPOSITION	WEIGHT	TEXTURE	GENETIC CLASS	OTHER
			TOP LEVEL			
			MIDDLE LEVEL			
			LOWEST LEVEL			

Part A. II. (cont.) Rocks and Minerals

Procedure: Choose two or three of the rocks that you have found. Examine them closely and describe the mineral components. If possible, crush part of the rock and separate the crushed material into piles of similar particles.

I. What happens when rocks are weathered?

II. What is Erosion?

III. Describe the differnece between the weathered surface of a rock and a freshly broken surface.

IV. In your search for different rocks, have you found a rock which is rounded, hollow, and contains crystals inside?

V. Note types of fossils found. Draw what you see and identify either here or back in classroom.

VI. Decide whether this area was created by man's influence or by nature's influence or both. List items to support your choice.

Part B. I.

TITLE: INVESTIGATING WEATHERING AND EROSION

PURPOSE: To recognize some of the evidence and effects of weathering and erosion in the Geology Station area.

Procedure: Look for rocks or landforms which show evidence of weathering.

Describe each feature clearly and tell whether you think that this is and example of Physical or Chemical Weathering. What do you think has caused the weathering in each case?

Remember: Physical Weathering may be caused by (1) Temperature change; (2) Frost Action; (3) Action of Plants: (4) Action of animals; (5) Abrasive action wins, water, and ice. Chemical Weathering may be caused by (1) Oxidation; (2) Carbonation; (3) Hydration.

Draw a diagram of the soil profile of the highest slope.

Label according to: A. Color

B. Size of particles

C. Thickness

D. Other characteristics

BED ROCK	PARENT ROCK	SUB SOIL	TOP SOIL

Evidence of Erosion at the Geology Station

Erosional Landforms	Cause	Sketch and/or Description

Weathering and Erosion (cont)

Part B. II.

Procedure: Look for evidence of Erosion. Describe each area where erosional action has taken place and identify any landforms or surface features that were formed due to erosion. What are the erosional agents in each case? (wind, water, ice, or directly by gravity) Land form examples (gully, talus slope, soil creep, oxbow lakes, sandbars, etc)

Evidence of Weathering at the Geology Station.

Evidence of Weathering	Type	Cause

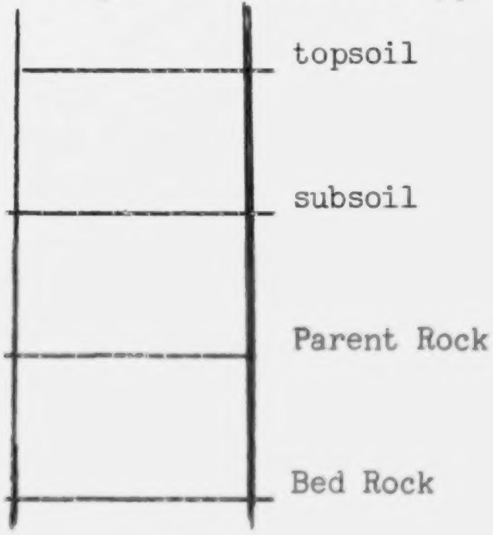
EXERCISE: Conservation Ressurection Soil

Behavioral Objectives: Upon completion of this exercise, the student will be able to point out the prevention of erosion through these processes:

1. Soil improvement
2. Proper drainage
3. Terracing
4. Tree and grass planting

Activities:

I. Draw a diagram of the soil profile of the highest slope and label according to the size and type of rocks found on the slope.

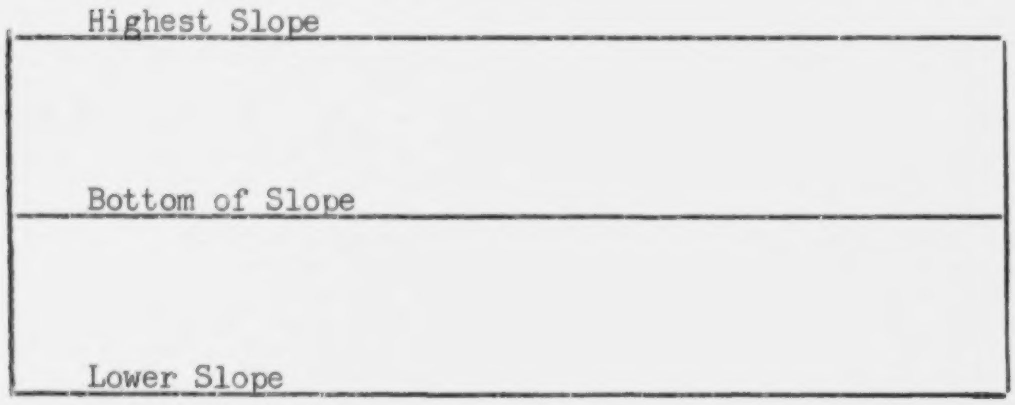


A. Color

B. Size of Particles

II. Have you noticed certain aspects of erosion which have occurred at the slope? In the following block diagram, place the corresponding numbers of the features which have been revealed by nature according to location and shape of structure.

1. Gullies
2. Talus Material
3. Folded Rock Layer
4. Resistent Rock Caps



Exercise: Conservation Ressurection Soil (cont.)

III. What has been the most effective tool of nature in the erosion of this area?

IV. Identify that there is erosion present

(a) List characteristics of an eroded area
(b) List correction methods
(c) Do some correction methods

V. Correction Activities

(a) To reduce improper drainage:

1. Place natural obstacles in gullies. Logs, rocks, etc.

2. Collect seeds and sow along banks and transplant honeysuckle.

3. Plant tree seedlings

(b) Terrace the slope

1. Fill sand bags and place at different levels in eroded area.

Robert E. Farmer

EXERCISE: Minerals (Rocks)

Behavioral Objectives: Following this exercise, the student should be able to:

1. Distinguish minerals (rocks) on the basis of metallic or non-metallic luster.
2. Demonstrate a scratch test procedure for determining the relative hardness of a rock.
3. Order a group of rocks according to relative hardness.
4. Construct a table of classification for a group of minerals based upon metallic or non-metallic luster and relative hardness.

Terms:
Metallic - looks like a metal - shiny

Non-Metallic - Does not look like a metal - dull or maybe glasslike

Hardness - How hard is it to scratch hardness table - Moh's Scale

Hardness	Common Items That Will Scratch
1	
2	Fingernail
3	
4	Penny
5	Window Glass
6	Good Knife
7	Steel File
8	This group should not apply
9	since we are not likely to
10	find Topaz, corundum or diamond

Possible Rocks or Minerals available in area:

Name	Hardness
Talc (White, Gray, Green)	1
Kadlinite	1-2
Shale	1
Calcite (Gray)	3
Chalcedoney	4-5
Chert	4-5
Hematite	5-6
Quartz	7

Activity - Hardness and luster

Exercise: Minerals (Rocks) (cont.)

Students should collect small rocks that appear different.

Students should classify the rocks according to metallic or non-metallic using hand lens.

Students should order the rocks according to hardness using Fingernails, Penny, Good Knife, and Steel File. (Knife and Steel File should be furnished by Instructor.)

Students should design a table to classify their rocks according to metallic and non-metallic and hardness.

Evaluation:

Students should take two rocks and identify their position in their table according to metallic, non-metallic and hardness.

James M. Major

EXERCISE: Conservation - Man and Nature

Purpose: Observation of evidences of man's attempts in conservation and of natural conservation

Behavioral Objectives: At the conclusion of this exercise, the student will be able to:

1. Identify evidence of man's endeavors at conservation
2. Identify evidence of natural conservation
3. State the general purposes of some observed conservation practices of man.
4. Tell the history of the Iron Banks Hill.
5. Point out evidence of steps or processes in natural conservation in the Iron Banks Hill area.

Procedure: A walk from YAS to Home Flock Area to Iron Banks Hill and back

Materials: Notebook, activity sheets, pencil and compass

1. Activity: Plot course of walk
   a. Locate Honker Dam, Snake Island, Home Flock Area, Iron Banks Hill, Beaver Lodges and Spring on map.
   b. Orient map and determine azimuths to be followed from point to point.
   c. What is the azimuth of each point from the YAS?

2. Activity: Observation and discussion of purpose of Honker Dam and Lake
   a. How does Honker Dam promote conservation?
   b. What evidence can you find on or near the Dam of Wildlife?

3. Activity: Observation and discussion of purpose and operation of Home Flock Area.
   a. What evidence of benefit to wildlife can you find?
   b. What evidence of wildlife in the area did you find?
   c. What different kind of plants, animals, or birds has man introduced in the area?

4. Activity: Follow the trail over the top of Iron Banks Hill
   a. Are there any changes in the type of plant population as the trail ascends the hill? What changes do you observe?
   b. What is happening to edge of the old iron diggings at the top of the hill?
   c. What strange (unusual) characteristics of the root system of trees at the edge do you observe? Can you explain this behavior?
   d. From above the diggings, can you find any evidence of erosion? If so, what evidence?

5. Activity: Investigation of the bottom of the diggings
   a. What kinds of plants do you find here?
   b. Do you find mosses?
   c. Do you find ferns?
   d. Do you find lichens?
   e. Do you find grasses?
   f. Do you find woody plants?
   g. Are there any big trees of just shrubs?
   h. What does the type or types of plant life found tell you about nature's attempt at conservation?

Exercise: Conservation - Man and Nature (cont.)

6. Activity: Visit to Beaver Lodges
   a. What evidence of presence of beavers can you find?
   b. What kinds and sizes of trees do beaver cut?
   c. What do the beavers do with trees they cut?
   d. Do beavers contribute to conservation? If so, how?
   e. Do beavers handicap conservation activities? If so, how?
   f. How do beavers manage to enter their lodges?
   g. How do the beaver breathe in their lodges?

7. Activity: Observation and discussion of purpose of fresh water spring
   a. Where does the spring originate?
   b. What type of life does the spring sustain?
   c. How does the spring affect conservation?
   d. Would the spring be affected by changes in the weather?
   e. Is the spring a tributary of a larger body of water?

Dorothy Kirchoff

EXERCISE: Weather Factor - Temperature

Behavioral Objectives: Following this exercise, the student will be able to:

1. Plot a graph indicating differences in temperature in the same area at different times of day for more than one day.
2. Give reasons why there is a difference
3. Plot a graph indicating differences in temperature in different areas at the same time of day.
4. Give reasons why there is a difference in temperature in different areas at the same time of day.
5. Tell why there are varying patterns of temperature in different areas and varying patterns of temperature at different times of day.

Materials: Centigrade Thermometer

Activity: Outdoor Temperatures

The students shall measure and record the temperature at three specified times each day in the following areas:

		Symbol
1.	Bare Ground in Direct Sunlight	⊛
2.	Bare Ground in the Shade	✳
3.	Grass in Direct Sunlight	+
4.	Grass in the Shade	‡
5.	In the edge of a wooded area.	○
6.	Fifty Steps into a wooded area.	⊕
7.	Six inches above the surface of a large body of water	ǂ
8.	Six inches below the surface of a large body of water	#

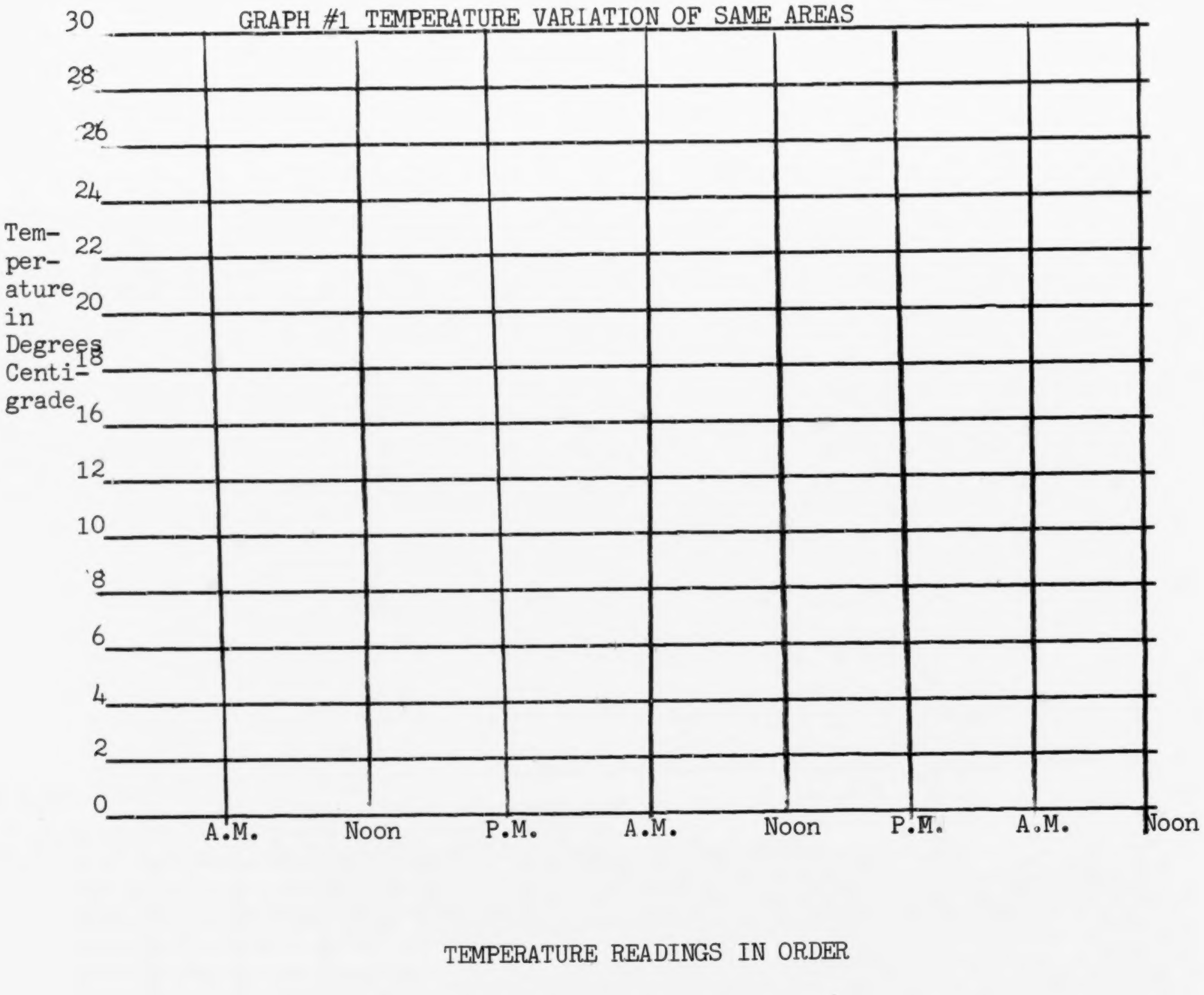
DATA TABLE

AREA		TEMPERATURE IN DEGREES CENTIGRADE							
		A.M.	NOON	P.M.	A.M.	NOON	P.M.	A.M.	NOON
Bare Ground	⊛								
Bare Ground	✳								
Grass	+								
Grass	‡								
Wooded Area	○								
Wooded Area	⊕								
Body of Water	ǂ								
Body of Water	#								

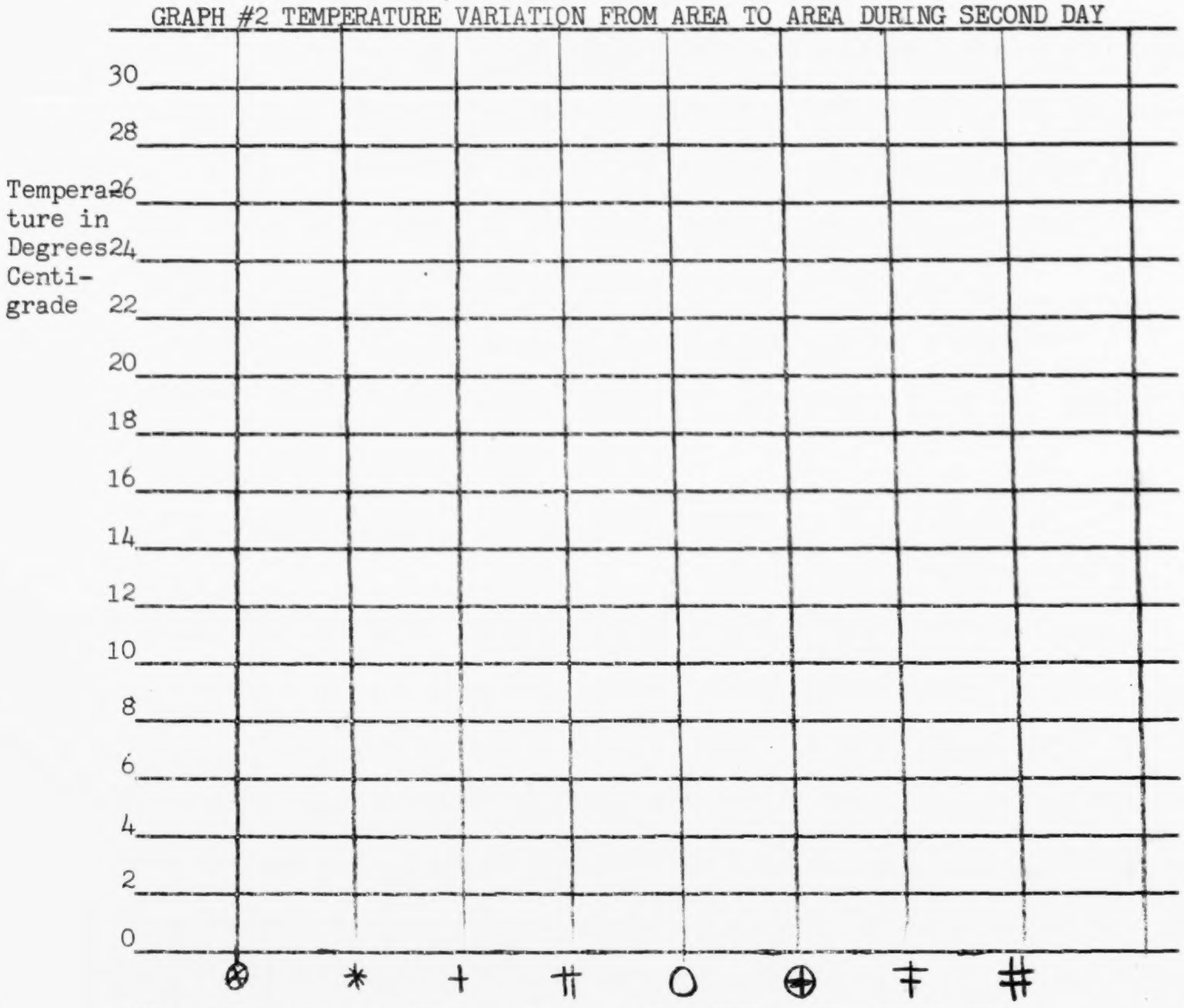
1. On a single sheet of graph paper the student should plot the temperatures of all eight areas for all readings using the symbols to indicate the area.

2. On a second sheet of graph paper the student should plot the temperature readings from area to area for the three readings taken. Use the following symbols for the line graphs.

A.M. = ○
Noon = +
P.M. = ⊕


GRAPH #1 TEMPERATURE VARIATION OF SAME AREAS

GRAPH #2 TEMPERATURE VARIATION FROM AREA TO AREA DURING SECOND DAY



AREAS INDICATED BY THEIR SYMBOLS. PLOT TEMPERATURE USING THE FOLLOWING SYMBOLS:

A.M. "O"; NOON "t"; P.M. "O"

QUESTIONS:
Is there any difference in the temperature in the same area at different times of day? Why?
Is there any difference in the temperature from one area to the next area? Why?
In which area would you rather be on a cool day? On a hot day? Why?
What kind of a patern of temperature differences from area to area occur in the morning? Why? At Noon? Why? In the Evening? Why?

James M. Major

EXERCISE: Weather Factor - Relative Humidity

Behavioral Objectives: Following this exercise, the student will be able to:

1. Operate a hygrometer to find the relative humidity.
2. Describe the weather accompanied by either a high, average, or low relative humidity.
3. Predict the kind of weather likely to follow either a high, average, or low relative humidity.

Materials: Wet bulb thermometer, dry bulb thermometer, relative humidity table or hygrometer.

Activity: Relative Humidity

Students should determine and record the relative humidity at three specified times each day.

Students should determine and record the kind of weather at the time the relative humidity is determined.

RELATIVE HUMIDITY DATA

Date									
Time of Day	a.m.	noon	p.m.	a.m.	noon	p.m.	a.m.	noon	p.m.
Relative Humidity									
Weather									

QUESTIONS:

1. What kind of weather accompanies a high relative humidity?
2. What kind of weather accompanies an average relative humidity?
3. What kind of weather accompanies a low relative humidity?
4. What kind of weather followed a high relative humidity?
5. What kind of weather followed a low relative humidity?
6. What kind of weather followed an average relative humidity?
7. How does a high relative humidity seem to affect your body while exercising?

James M. Major

RELATIVE HUMIDITY FROM WET AND DRY BULB THERMOMETER (CENT. SCALE)

This table gives the approximate relative humidity directly from the reading of the air temperature (dry bulb) (t°C) and the wet bulb (t'°C). It is computed for a barometic pressure of 74.27 cm Hg. Errors resulting from the use of this table for air temperatures above −10°C and between 77.5 and 71 cm Hg will usually be within the errors of observation.

i − t' t	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0
−10	93	87	80	74	67	61	54	48	41	35	28	22	16	9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
− 9	94	88	81	75	69	63	57	51	45	39	33	27	21	15	9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
− 8	94	88	83	77	71	65	60	54	48	43	37	32	26	20	15	10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
− 7	95	89	84	78	73	67	62	57	52	46	41	36	31	25	20	15	10	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
− 6	95	90	85	79	74	69	64	59	54	49	45	40	35	30	25	20	15	11	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
− 5	95	90	86	81	76	71	66	62	57	52	48	43	39	34	29	25	20	16	11	7	....	....	....	....	....	....	....	....	....	....	....	....	....	....
− 4	95	91	86	82	77	73	68	64	59	55	51	46	42	38	33	29	25	21	17	12	....	....	....	....	....	....	....	....	....	....	....	....	....	....
− 3	96	91	87	82	78	74	70	66	62	57	53	49	45	41	37	33	29	25	21	17	8	....	....	....	....	....	....	....	....	....	....	....	....	....
− 2	96	92	88	84	79	75	71	68	64	60	56	52	48	44	40	37	33	29	25	22	12	....	....	....	....	....	....	....	....	....	....	....	....	....
− 1	96	92	88	84	81	77	73	69	66	62	58	54	51	47	43	40	36	33	29	26	17	8	....	....	....	....	....	....	....	....	....	....	....	....
0	96	93	89	85	81	78	74	71	67	64	60	57	53	50	46	43	40	36	33	29	21	13	5	....	....	....	....	....	....	....	....	....	....	....
1	97	93	90	86	83	80	76	73	70	66	63	59	56	53	49	46	43	40	36	33	25	17	10	....	....	....	....	....	....	....	....	....	....	....
2	97	93	90	87	84	81	78	74	71	68	65	62	59	55	52	40	46	43	40	37	29	22	14	7	....	....	....	....	....	....	....	....	....	....
3	97	94	91	88	84	82	78	76	72	70	67	64	61	58	55	52	49	46	43	40	33	26	19	12	5	....	....	....	....	....	....	....	....	....
4	97	94	91	88	85	82	79	77	74	71	68	65	62	60	57	54	51	48	46	43	36	29	22	16	9	....	....	....	....	....	....	....	....	....
5	97	94	91	88	86	83	80	77	75	72	69	67	64	61	58	56	53	51	48	45	39	33	26	20	13	7	....	....	....	....	....	....	....	....
6	97	94	92	89	86	84	81	78	76	73	70	68	65	63	60	58	55	53	50	48	41	35	29	24	17	11	5	....	....	....	....	....	....	....
7	97	95	92	89	87	84	82	79	71	74	72	69	67	64	62	59	57	54	52	50	44	38	32	26	21	15	10	....	....	....	....	....	....	....
8	97	95	92	90	87	85	82	80	77	75	73	70	68	65	63	61	58	56	54	51	46	40	35	29	24	19	14	8	....	....	....	....	....	....
9	98	95	93	90	88	85	83	81	78	76	74	71	69	67	64	62	60	58	55	53	48	42	37	32	27	22	17	12	7	....	....	....	....	....
10	98	95	93	90	88	86	83	81	79	77	74	72	70	68	66	63	61	59	57	55	50	44	39	34	29	24	20	15	10	6	....	....	....	....
11	98	95	93	91	89	86	84	82	80	78	75	73	71	69	67	65	62	60	58	56	51	46	41	36	32	27	22	18	13	9	5	....	....	....
12	98	96	93	91	89	87	85	82	80	78	76	74	72	70	68	66	64	62	60	58	53	48	43	39	34	29	25	21	16	12	8	....	....	....
13	98	96	93	91	89	87	85	83	81	79	77	75	73	71	69	67	65	63	61	59	54	50	45	41	36	32	28	23	19	15	11	7	....	....
14	98	96	94	92	90	88	86	84	82	70	78	76	74	72	70	68	66	64	62	60	56	51	47	42	38	34	30	26	22	18	14	10	6	....
15	98	96	94	92	90	88	86	84	82	80	78	76	74	73	71	69	67	65	63	61	57	53	48	44	40	36	32	27	24	20	16	13	9	6

	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0	12.5	13.0	13.5	14.0	14.5	15.0	15.5	16.0	16.5	17.0	xx
16	95	90	85	81	76	71	67	63	58	54	50	46	42	38	34	30	26	23	19	15	12	8	5	....	....	....	....	....	....	....	....	....	....	....	....
17	95	90	86	81	76	72	68	64	60	55	51	47	43	40	36	32	28	25	21	18	14	11	8	....	....	....	....	....	....	....	....	....	....	....	....
18	95	91	86	82	77	73	69	65	61	57	53	49	45	41	38	34	30	27	23	20	17	14	10	7	....	....	....	....	....	....	....	....	....	....	....
19	95	91	87	82	78	74	70	65	62	58	54	50	46	43	39	36	32	29	26	22	19	16	13	10	7	....	....	....	....	....	....	....	....	....	....
20	96	91	87	83	78	74	70	66	63	59	55	51	48	44	41	37	34	31	28	24	21	18	15	12	9	6	....	....	....	....	....	....	....	....	....
21	96	91	87	83	79	75	71	67	64	60	56	53	49	46	42	39	36	32	29	26	23	20	17	14	12	9	6	....	....	....	....	....	....	....	....
22	96	92	87	83	80	76	72	68	64	61	57	54	50	47	44	40	37	34	31	28	25	22	19	17	14	11	8	6	....	....	....	....	....	....	....
23	96	92	88	84	80	76	72	69	65	62	58	55	52	48	45	42	39	36	33	30	27	24	21	19	16	13	11	8	6	....	....	....	....	....	....
24	96	92	88	84	80	77	73	69	66	62	59	56	53	49	46	43	40	37	34	31	29	26	23	20	18	15	13	10	8	....	....	....	....	....	....
25	96	92	88	84	81	77	74	70	67	63	60	57	54	50	47	44	41	39	36	33	30	28	25	22	20	17	15	12	10	8	....	....	....	....	....
26	96	92	88	85	81	78	74	71	67	64	61	58	54	51	49	46	43	40	37	34	32	29	26	24	21	19	17	14	12	10	5	....	....	....	....
27	96	92	89	85	82	78	75	71	68	65	62	58	56	52	50	47	44	41	38	36	33	31	28	26	23	21	18	16	14	12	7	....	....	....	....
28	96	93	89	85	82	78	75	72	69	65	62	59	56	53	51	48	45	42	40	37	34	32	29	27	25	22	20	18	16	13	9	....	....	....	....
29	96	93	89	86	82	79	76	72	69	66	63	60	57	54	52	49	46	43	41	38	36	33	31	28	26	24	22	19	17	15	11	7	....	....	....
30	96	93	89	86	83	79	76	73	70	67	64	61	58	55	52	50	47	44	42	39	37	35	32	30	28	25	23	21	19	17	13	9	5	....	....
31	96	93	90	86	83	80	77	73	70	67	64	61	59	56	53	51	48	45	43	40	38	36	33	31	29	27	25	22	20	18	14	11	7	....	....
32	96	93	90	86	83	80	77	74	71	68	65	62	60	57	54	51	49	46	44	41	39	37	35	32	30	28	26	24	22	20	16	12	9	5	....
33	97	93	90	87	83	80	77	74	71	68	66	63	60	57	55	52	50	47	45	43	41	39	37	35	32	30	28	26	24	23	19	15	12	8	5
34	97	93	90	87	84	81	78	75	72	69	66	63	61	58	56	53	51	48	46	44	42	40	38	36	34	32	20	28	26	24	20	17	13	19	7
35	97	94	90	87	84	81	78	75	72	69	67	64	61	59	56	54	51	49	47	45	43	41	39	37	35	33	31	29	27	25	21	18	15	11	8
36	97	94	90	87	84	81	78	75	73	70	67	64	62	59	57	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	23	19	16	13	10
37	97	94	91	87	84	82	79	76	73	70	68	65	63	60	58	55	53	51	48	47	45	43	41	39	37	35	33	31	29	27	24	20	17	14	11
38	97	94	91	88	84	82	79	76	74	71	68	66	63	61	58	56	54	51	49	48	46	43	42	39	38	36	34	32	30	28	25	22	18	15	12
39	97	94	91	88	85	82	79	77	74	71	69	66	64	61	59	57	54	52	50	48	46	44	42	40	38	36	35	33	31	29	26	23	20	16	14
40	97	94	91	88	85	82	80	77	74	72	69	67	64	62	59	57	54	53	51																

EXERCISE: Weather Factors - Cloud Cover

Behavioral Objectives: Following this exercise, the student should be able to:

1. Point out cirrus, cumulus, stratus, and nimbus clouds.

2. Tell what kind of weather is most likely to follow a cloud cover of cirrus, cumulus, stratus, and nimbus clouds.

Activity: Cloud Cover

Terms: Cloud s

Cirrus - curly, white, and high up in the sky
Stratus - low, thin, and fog-like
Cumulus - pile-up, floating white masses about a mile above the land
Nimbus - dark gray and rather formless, filled with rain.

Record cloud cover at breakfast, lunch, and dinner in data table using terms above:

	A.M.	Noon	P.M.	A.M.	Noon	P.M.	A.M.
Kind of Weather							
Kind of Clouds							

QUESTIONS:

1. What kinds of weather followed each kind of cloud cover observed?
2. What kind of weather would you predict would follow these cloud covers?
   A. Cirrus
   B. Stratus
   C. Cumulus
   D. Nimbus
3. Are the clouds moving?
4. Can you see new clouds forming?
5. Do you see clouds breaking up?
6. Can you find shapes among the clouds?
7. What shapes do you find?
8. What is a cloud?

James M. Major

EXERCISE: Weather Factor - Wind

Behavioral Objectives: Following this exercise, the students should be able to:

1. Estimate with the use of the Beaufort Scale, the velocity (speed) of the wind.
2. Determine the direction of the wind, using a wind vane and compass.
3. Plot a graph showing the variations of wind velocity during the period..
4. Predict the likely kind of weather one could expect using the wind direction, velocity, and current weather conditions.

Materials: Beaufort Scale, wind estimation scale (attached), simple wind vane or wind sock, compass, anneometer if available.

Activity: Wind - Direction and Velocity

Students should observe and record the wind velocity and direction at three specified times each day.

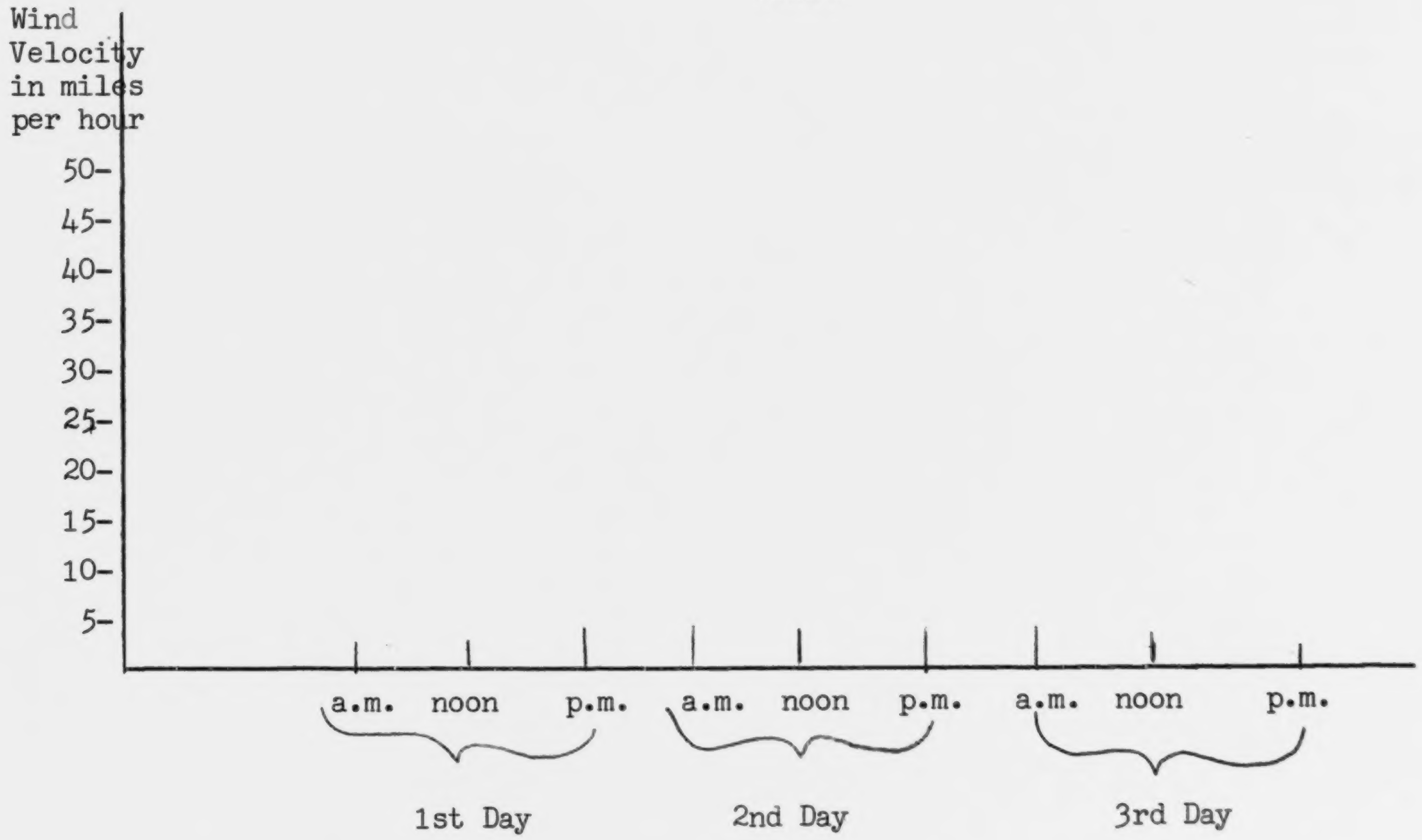
Students should observe and record the kindof weather at the time the wind direction and estimated velocity is observed.

Students should plot a graph showing the wind velocity during the period of their observation.

WIND DIRECTION AND VELOCITY DATA

Date										
Time of Observation	am	noon	pm	am	noon	pm	am	noon	pm	
Velocity										
(from) Direction										
Weather										

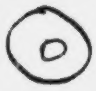
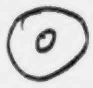
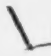
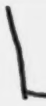
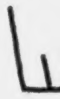
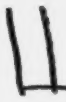
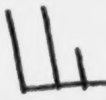
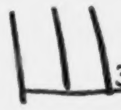
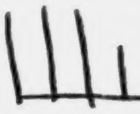
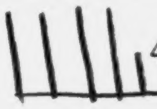
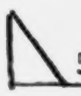
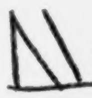
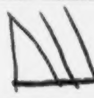
GRAPH



QUESTIONS:

1. Does the wind velocity remain the same?
2. Does the wind velocity seem to change at any specific time or period of the day?
3. Does the direction of the wind appear to have any affect on the kind of weather one experiences? Why?
4. How does the wind velocity affect your comfort out of doors?
5. How does the wind direction and velocity seem to affect the kind of weather one would expect the next day?
6. Does these seem to be any relation between the wind direction and velocity at a specific time, and the kind of weather you have at this time?

BEAUFORT SCALE-WIND ESTIMATION

Beaufort Number	mph	knots	Description	Observation	Weather Map Symbols
0	0-1	0-1	calm	smoke rises vertically	 calm
1	1-3	1-3	light air	smoke drifts slowly	 calm
2	4-7	4-6	slight breeze	leaves rustle	 5 knots
3	8-12	7-10	gentle breeze	leaves and twigs in motion	 10 knots
4	13-18	11-16	moderate breeze	small branches move	 15 knots
5	19-24	17-21	fresh breeze	small trees sway	 20 knots
6	25-31	22-27	strong breeze	large branches sway	 25 knots
7	32-38	28-33	moderate gale	whole trees in motion	 30 knots
8	39-46	34-40	fresh gale	twigs break off trees	 35 knots
9	47-54	41-47	moderate gale	branches break	 45 knots
10	55-63	48-55	whole gale	trees snap and are blown down	 50 knots
11	64-72	56-63	storm	widespread damage	 60 knots
12	73-82	64-71	hurricane	extreme damage	 70 knots

EXERCISE: Weather Factor - Atmospheric Pressure

Behavioral Objectives: Following this exercise, the student should be able to:

1. Point out the kind of weather that accompanied a high barometric reading.

2. Predict the kind of weather likely to follow a rapid rise in barometric pressure; rapid fall in barometric pressure.

3. Predict the kind of weather likely to accompany a fairly constant barometric pressure.

Materials: Barometer

Activity: Atmospheric (Air) Pressure

Students should observe and record the atmospheric pressure at three specified times each day.

Students should observe and record the kind of weather at the time the atmospheric pressure is observed.

ATMOSPHERIC PRESSURE DATA

	Pressure in inches of Mercury					
	A.M.	NOON	P.M.	A.M.	NOON	P.M.
PRESSURE						
WEATHER						
	A.M.	NOON	P.M.	A.M.	NOON	P.M.
PRESSURE						
WEATHER						

QUESTIONS:

1. What kind of weather accompanies a high atmospheric pressure?
2. What kind of weather accompanies a low atmospheric pressure?
3. If the barometric pressure drops rapidly, what kind of weather follows?
4. What kind of weather follows a rising barometric pressure?
5. Did the time of day appear to have any effect on the barometric pressure?
6. Do you think the barometric pressure would be helpful in making a weather forecast?

James M. Major

MATH

Exercise: Time-Telling using shadow stick.

Behavioral Objectives:

Following this exercise, the student should be able to:

1. Tell time using shadow stick.
2. Tell the season of year using shadow stick.
3. Tell the time zones and locations using shadow stick.

Material:

2 Ft. stick app., compass for direction, worksheets, and string.

Activity: Time - Telling time using shadow stick.

I. Terms:

1. Time zones: A geographical region within which the same standard of time is used.
2. Eastern: Pertaining to the eastern section of the country.
3. Central Standard: Pertaining to the central section of the country.
4. Atlantic: The time zone over the east coast of the United States.
5. Pacific: The time zone over the western coast of the United States.
6. Mountain: Time zone over the western part of the country.
7. Shadow Stick: Simplified form of the sundial.
8. Sundial: An early instrument used to tell the time of the day.

II. Procedure:

1. Give background information.
2. Use compass to find direction due north.
3. Place stick in ground upright in position.
4. Use string to make circle around the stick, using the stick as center point of the circle. String should be about the same length of the shadow stick.

Math - Time

5. Put the face on the clock (numbers).

6. The position of the shadow will tell the time of day.

7. The length of the shadow will tell the season of the year.

III. Follow up questions

1. What time zone do you live in?

2. What are other time zones?

3. Where are they located?

4. What is a shadow stick?

5. Can you tell the time of day by the position of the shadow?

6. Can you tell the season by the length of the shadow?

IV. Supplementary

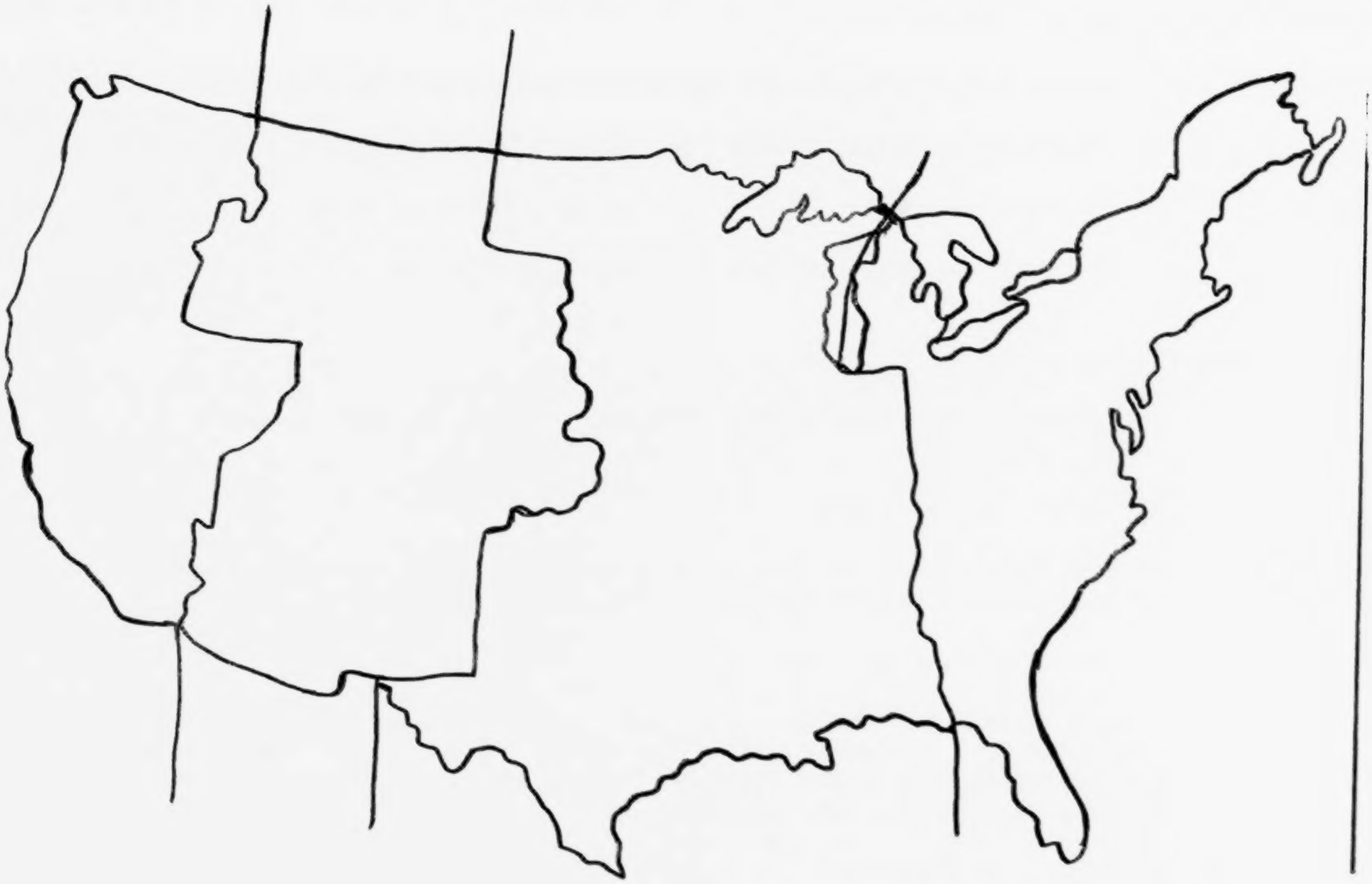
1. How much longer will the shadow of the stick be an hour later?

2. If it is 12:00 noon in the central time zone, what time will it be in the Pacific time zone?

Christine Jones
Versil Withrow

WORK SHEET

Time zone map



MEASURING THE HEIGHT OF TREES

EXERCISE: Measuring Tree Height

Behavioral Objectives:

Following this exercise, the student should be able to:

1. Measure the height of any tree using a latitude gun.
2. Measure the height of any tree using a Biltmore Stick.
3. Measure the height of any tree using estimation.

Materials:

Latitude gun, biltmore stick, yardstick, ruler, or tape measure (pace size).

I. Activity: Latitude Gun

Student aims at top of tree until gun reaches 45°. Distance from student to tree plus height of student equals height of tree.

II. Activity: Biltmore Stick

Student stands 66 feet from the tree. Hold stick in fist so base of tree coinsides with the lower end of the stick. Raise eye to top of tree without moving the head. Height of tree till be marked on the stick where the top of tree hits the stick.

III. Activity: Estimation

Measure the height of a student using a measuring device. This student then stands at the base of the tree to be measured. Another student stands about 100 feet away and estimates how many times the student's height will fit up the tree. Then he multiplies the number of times by the height of the tree.

QUESTION:

1. How tall is the tree?

Jane McCool

MEASURE HEIGHT OF A TREE

Season: Exercise can only be done when the sun is shining.

Objective: At the end of this exercise, the student should be able to:

- (a) Use three known related values and by using ratio and proportion derive a fourth related value.
- (b) Take the length of a yardstick's shadow and the length of a tree's shadow, and by using ratio and proportion, find the height of the tree.

Materials: Yardstick and tape measure (measured pace).

Procedure:

1. Select the tree(s) to be measured.
2. Hold the yardstick at right angles with (perpendicular to) the ground.
3. Measure the length of the yardstick's shadow using a tape measure or pace measure.
4. Measure the length of the tree's shadow by same method.
5. Using the following proportion

   $$\frac{\text{length of yardstick}}{\text{length of yardstick's shadow}} = \frac{\text{height of tree}}{\text{length of tree's shadow}}$$

   Place the measured values in their appropriate places. Multiply the yardstick's length times the length of the tree's shadow and divide this by the length of the yardstick's shadow. This gives the tree's height.
6. Repeat the above two steps for all other trees that are to be measured.

Sandra Sternberg

Exercise: Measuring the heights of objects by the "12 to 1" ratio method.

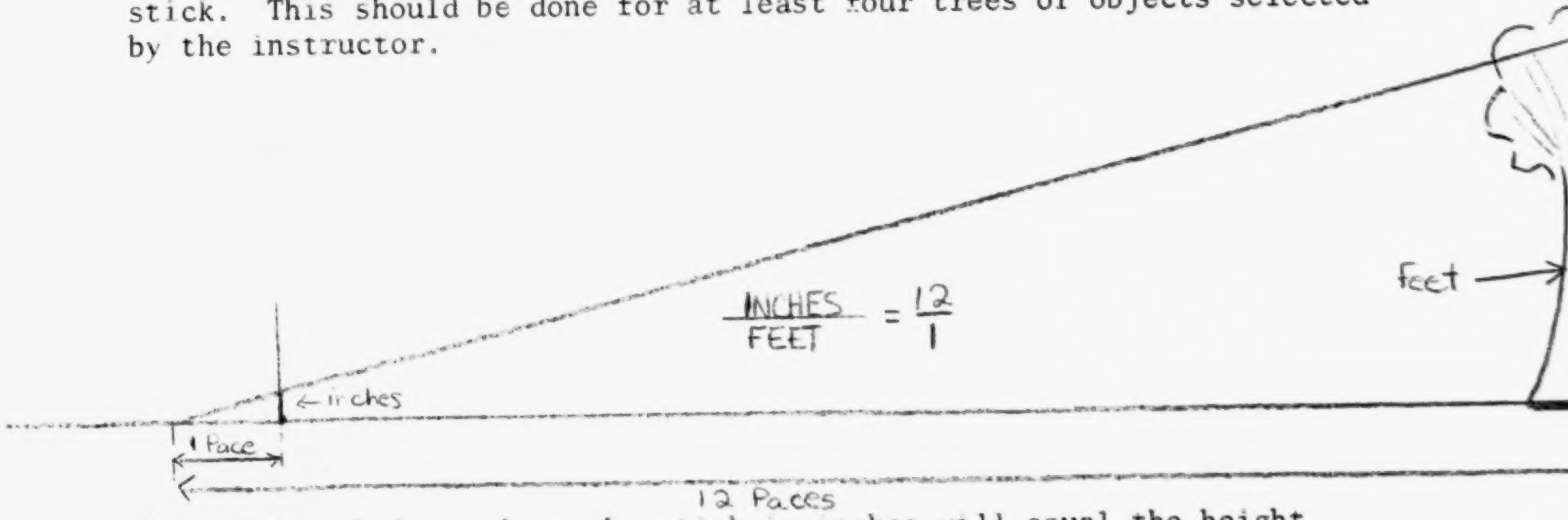
Behavioral Objectives: At the conclusion of this exercise the student should be able to:

1. Tell what a pace is and the length of his own pace.
2. Step off even paces in a straight line.
3. Measure the approximate height of a tree or any other object by the "12 to 1" ratio method.
4. Tell why the "12 to 1" ratio method works.

Procedure:

The instructor should have measured a definite distance (one hundred feet) in a straight line on a fairly level area. The instructor defines a pace as two steps - if one steps off with his left foot first, when his right foot strikes the ground (the second step) that will be one pace. After the students have paced the measured distance enough times to get the same number of paces two or three times, each student calculates the length of his or her pace.

The student then selects a tree whose height he wishes to estimate. Selecting a path as level as possible, the student steps off eleven paces and sticks a stick, longer than a yardstick, in the ground. The student then takes one more pace and marks the spot. Lying on the ground, the student aligns the top of the tree with a mark on the stick. This should be done for at least four trees or objects selected by the instructor.



The height of the mark on the stick in inches will equal the height of the tree in feet. The reason being that we have two similar triangles which have ratio's of 1 to 12.

If one wishes to use the metric system, one simply changes the ratio to 1 to 100, since one meter equals one hundred centimeters.

Questions:

1. What is a pace?
2. What is the length of your pace in feet or meters?
3. What is your estimated height of trees (or objects) number 1, 2, 3 and 4?
4. How do your results check against those of others in your group?
5. Why does the "12 to 1" ratio method work?

(This idea was borrowed from Sam Johnson's"REACHIGH OUTDOOR WHIRL")

James M. Major

EXERCISE: Travel Rate of Ants

Behavioral Objectives: At the conclusion of this exercise, the student will be able to:

1. Measure to the nearest centimeter or fraction of an inch.
2. Compute the rate of speed when the time and distance are known.
3. Compare distances.
4. Convert small units of measurements to larger units.

Materials: An ant (any small animal will do), a watch, and a yard stick, meter stick or tape measure.

I. Activity:

1. Measure the distance the ant travels for a short period of time, perhaps a minute.
2. Find the length of the ant and how many of its body lengths were represented by the distance it traveled in the period of time that it was observed.
3. Determine how far they would go if they traveled the same number of their own body lengths in the same period of time.
4. Convert the distance they would travel into miles per hour.
5. This will be much easier to compute if the metric system is used.

EXERCISE: Finding the area of a circle

Behavioral Objectives: At the conculsion of this exercise, the student should be able to:

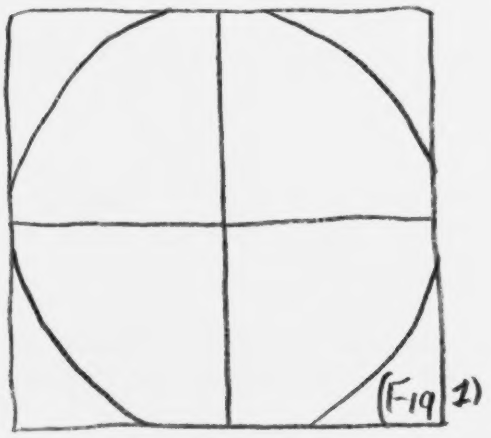
1. Count the number of square units in an area.
2. Estimate the area.
3. Substitute one area for another.
4. State the rule that the area of a circle is about three squares of the radius.

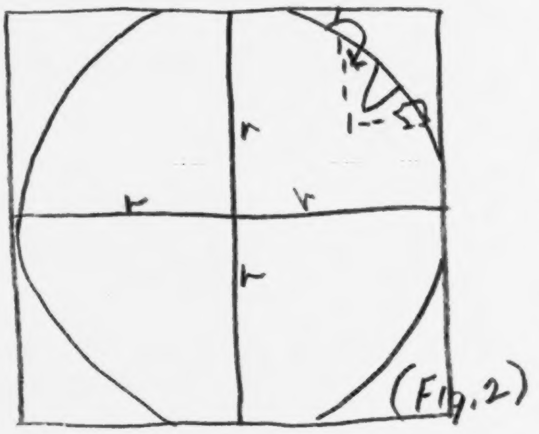
Materials: A string about seven feet long. Several foot rulers or yard sticks or straight sticks.

Exercise: Find the area of a circle (cont.)

1. Activity:

   1. Form a string into a circle with a radius of about one foot.
   2. How can we measure the area of a circle?
   3. Place the rulers or sticks across the circle and then frame the circle. (figure (1)


(Fig 1)



(Fig. 2)

   4. Now we have four squares. What is the area of these squares? (4 ft. square)
   5. Are the squares inside the circle?
   6. Approximately what part of each square lies outside the circle? (A little less than ¼)
   7. If we call the distance from the center of the circle to the outer edge "r", how many square "r's" would we have in the area of the circle? (figure 2) (About 3/4 of 4 or about 3 squares) (Area of a circle is r^2)

Doris Crutchfield

EXERCISE: Perimeter and Area of Closed Figures

Behavioral Objectives: Following this exercise, the student should be able to:

1. Construct a closed figure.
2. Arrange figures according to the estimated area.
3. Generalize that all figures with the same perimeter do not have the same area.

Material: Several strings the same length. (About 4 feet)

I. Activity:

1. Give each student a string and ask him to form a closed figure using all the string. Suggest that they not all make triangles or rectangles.
2. Compare the areas of the figures formed. First selecting the largest areas, then the smaller until you reach the smallest.

Questions:

1. What do you know about the perimeter of these figures?
2. Do you think the same thing is true of the areas?
3. What kind of figures seem to have the greatest area?
4. Now see if you can form a figure with a greater area than your last figure.
5. What do you suppose would be the greatest area you could form with your string?

SUPPLEMENTAL EXERCISE: (Use if the student does not succeed in the activity)

II. Activity:

1. Imagine your string is 16 units long and form a square with it. How many units are on each side? What is the area of the square?
2. Form a rectangle with your 16 unit string that is one unit wide. How long is the rectangle? What is the area of the rectangle?
3. Compare the area of the square with the area of the rectangle.

Jane McCool

GEOMETRY

EXERCISE: Geometrical Shapes in Nature

Behavioral Objective:

Following this exercise, the student should be able to:

1. Identify geometrical shapes occuring naturally in the outdoors.

Materials:

Pencil and paper with representational geometric shapes drawn upon it with space for student notations.

I. Activity: While on a nature walk, or on the way to or back from any activity, stop several times to look around and search for spheres, cones, squares, cylinders, cubes and rectangles. List the objects found on a sheet under the appropriate drawing.

QUESTIONS:

1. Were you able to find all of the shapes?
2. Which shape seems to occur most frequently?
3. Are there any you did not find at all?

Jane McCool

Fourth and Fifth Grades

FORESTRY

I. Objectives

1. To develop in children an awareness of and an appreciation for natures's laboratory.

2. To help children use the natural environment as a source of information.

II. Concepts

1. Changes in vegetation will take place over a number of years

2. Environment influences change

3. Grass is the first stage of plant succession of forest (grass from light and winged seed)

4. Heavier seeded sun-tolerant plants are brought in by animals

5. Climax vegetation is the last stage

6. The forests may be controlled by man

7. Uses of the forest.

   a. jobs for man
   b. homes for animals
   c. recreation

8. Enemies of the forest

   a. man
   b. fire
   c. disease
   d. insects
   e. natural forces

III. Activities

A. Map

1. Estimate the number of trees in a given area, the number of leaves on a tree, birds in a flock, insects in a group as compared to another area.

2. Use a yardstick in measuring the area to be used. Make use of tape measures.

3. Use comparisons (more or less, short or tall, fast or slow, etc.)

4. Find area, circumference, radius, diameter.

5. Study perpendicular and horizontal lines, right angles.

6. Make use of compass

B. Language Arts

1. Vocabulary Study
2. Recording (observations on field trips)
3. Reporting
   a. oral
   b. written
   c. encourage use of reference books
4. Write original poems and stories

C. Social Studies

1. Study the history of the people who inhabit the area.

2. How did the people in the past and at the present make use of their resources to serve their needs?

3. Identify plants used by man - which are harmful or helpful. What are some of the by-products developed by man?

D. Art

1. Draw scenes or construct a mural

2. Make a diorama

3. Make charts

4. Collect and mount specimens

5. Make a booklet

IV. Evaluation

1. By observation

2. By tests

3. Was this a valid lesson?

4. Can this lesson be applied to anything else?

Lois Rice
Julia Thompson

FOREST MEASUREMENTS

Objective: To familarize the students with various units of measure and some common uses in the out-of-doors.

I. Units of Measure

   A. Distance

      1. inch
      2. foot
      3. yard
      4. chain
      5. mile

   B. Volume

      1. gallon
      2. cubic foot
      3. cord
      4. board foot

   C. Area

      1. acre
      2. square foot
      3. square inch

   D. Weight

      1. pound
      2. ton

II. Measurements

   A. Diameter

   B. Radius

   C. Circumference

   D. Perimeter

   E. Weight

   F. Volume

   G. Distance

   H. Area

III. Projects

A. Distance (foot) and Area (acre and square foot) problem

1. With a 12-inch ruler and a stick, mark off one square foot on the ground. Establish the distinction between foot, square foot, and foot square.

2. Along a straight road or path, place two stakes in the ground 300 feet apart by measuring the distance with a tape.

   a. Have students walk this distance and count the number of steps they take. Next have each student determine his individual step-distance by dividing the number of steps he took into 300 feet. His answer will probably include a decimal or a fraction. Make sure he remembers his answer.

   b. In a large open field have two girl students stand 209 feet apart along a straight fence or road. Let two boy studnets pace 209 feet away from the girls at a 90° angle to the road or fence (use compasses to be sure of the angle). These four students form the corners of one square acre. One square acre contains 43,560 square feet.

      (1) An alternative to using a compass is to use a rope with 13 knots spaced equal distance apart. Hold the two end knots together and pull the rope into a triangle with sides three lengths, four lengths, and five lengths long. This forms a right triangle and you can sight down the sides to be sure your acre is square.

      (2) An acre covers 43,560 square feet of area regardless of the shape of the area. What is the acreage of a rectangle 600 feet by 726 feet: (Answer: 10 acres) A=length x width. The area of a triangle with a base of 2178 feet and an altitude of 400 feet? (Answer: 10 acres)

$$A = \frac{\frac{1}{2}(b \times a)}{43{,}560}$$

      (3) One square acre contains ten square chains (NOTE: 10 square chains and not 10 chains square). One chain is equal to 66 feet.

         (a) How many acres are in an area 30 chains long by 20 chains wide? (Answer: 60 acres)

         (b) How many chains are in one mile of length? (Answer: 80)

         (c) How many acres are in one square mile? (Answer: 640) A square mile is also known as a section.

3. Find a tree stump or cross section of a tree.

   a. Measure the circumference with a cloth tape

b. Measure the diameter
c. Measure the radius
d. Count the annual rings and determine the age
e. Measure off a one-inch distance from the bark toward the center of the tree and see how long it took the tree to grow one inch in radius.

B. Volume and Weight

1. Gallon

a. Weigh a container holding one gallon of water, then weigh the container without the water and determine the weight of the water by subtraction. (Answer: 8 pounds)

b. If one acre of mature oak trees absorbs 2600 gallons of water per day (Plant Ecology, Weaver and Clements), how many pounds does it absorb in a day? How many tons of water?

2. Square Foot, Cubic Foot, Cubic Yard

a. You want to build a concrete nature trail through the forest. You pace the distance and find it is 300 feet. If the trail is to be six feet wide, how many square feet of surface does it cover? (Answer: 1800 square feet)

b. If the trail is 300 feet long, 6 feet wide, and 4 inches deep, how many cubic feet does it contain? (Answer: 600 cubic feet)

c. Concrete is sold by the cubic yard and one cubic yard contains 27 cubic feet (3'x3'x3'=27'). How many cubic yards should you buy in order to build this walk? (Answer: 22.2)

3. Board Foot and Cord

a. See lesson plan "Harvesting the Forest".

b. Summary: Board foot is a piece of lumber 1" thick, 12" wide, 1' long. Cord is a stack of small logs or bolts containing 128 cubic feet of wood, bark and air space.

IV. Advanced Projects

A. Sampling Methods

1. Starting at a random point, pace 2½ chains into the forest along a straight compass line.

2. Establish a circular plot 1/10 acre in size.

a. What is the radius of this plot?

b. ($r = \sqrt{\frac{A}{\pi}}$) NOTE: π = 3.14 or 3 1/7 (Answer: 37.2 feet)

3. Count all the trees 6 inches or larger in diameter on this plot. How many trees do you have per acre if this plot is typical? (Answer: Number of trees on plot x 10)

4. Measure each tree 12 inches in diameter or larger and determine the board feet of timber on the plot. If your plot is typical, what is the timber volume per acre?

5. Additional plots can be taken at a predetermined spacing until you have a typical sample of the entire area.

6. The number of trees per plot; the size range on a single plot; the volume variation between plots can all be graphed in line or bar graphs as a follow-up exercise in the classroom.

T.V.A. Worksheet

ASTRONOMY

EXERCISE: Latitude Identification

Behavioral Objectives:

Following this exercise, the student should be able to:

1. Name his present position according to latitude.
2. Check the accuracy of his findings.

Materials:

Latitude gun, map of the area which has latitude markings.

1. Activity: Use a latitude gun to sight at the north star. The latitude may be read on the latitude gun where the string crosses the protractor. Check the accuracy of the reading on a map.

QUESTIONS.

1. Can you name your present latitude position?
2. Can you check the accuracy of your findings?

Jane McCool

APPENDIX: Latitude Gun

Construction of latitude gun

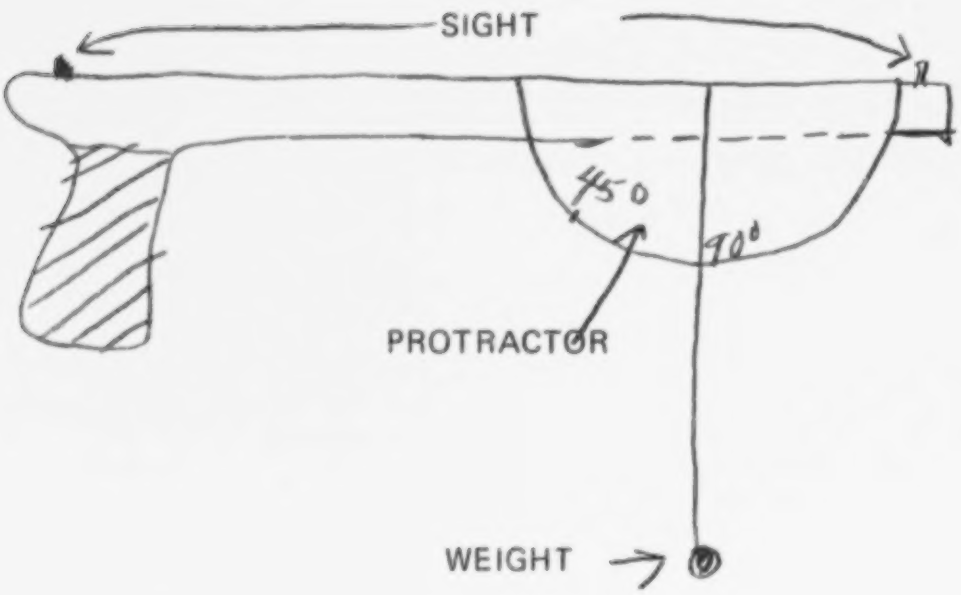
Behavioral Objectives:

1. Construct a latitude gun.

Materials:

Two pieces of wood nailed together in a L shape, two nails, four thumbtacks, strings and a washer or nut for weight, and a protractor.

I. Activity: Construct the gun as the diagram.



Jane McCool

EXERCISE - Astronomy - Constellation identification

Behavioral Objectives:

Following the exercise, the student should be able to:

1. Determine the direction of north by the stars.
2. Name and point out at least three constellations.
3. Locate and point out stars of 0-1-2-3-4 magnitude, if all have been visible.

Materials? Star map, flashlight, pencil and pad

Activity: Students should sit quietly and study the stars in order to locate the brighter ones for orientation.

Students should select first the constellation Ursa Major (Big Dipper) from star map then locate it in the sky.

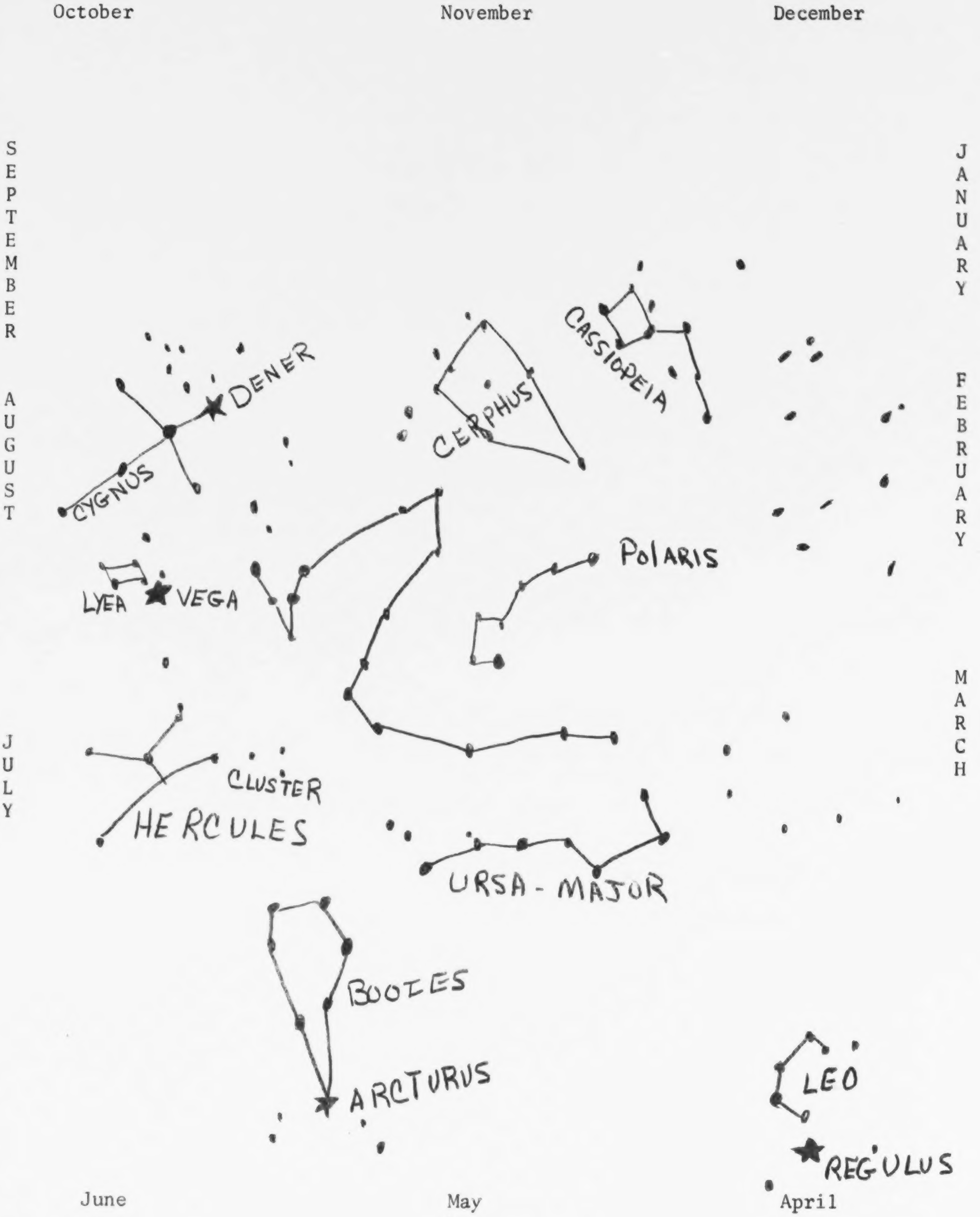
Students should locate in order the following: Polaris (North Star), Ursa Minor (Little Dipper), Draco (The Dragon), Cassidpeia, Bootes, Arcturus (A 0 Magnitude Star), Cygnus (The Swan), Cepheus, Lyra, Vega (0 Magnitude Star), Hercules, Leo and Regulus (1 Magnitude Star), Deneb (1 Magnitude Star). (Some of these may not be visible.)

Students should plot their own star map of the location of the constellations they are able to recognize.

Questions:

1. How many stars are there in the Big Dipper?
2. Can you find a double star in the Big Dipper?
3. What two constellations are on the opposite side of the North Star from the Big Dipper.
4. What is peculiar about the Little Dipper?
5. Could you find Arcturus the Star of 0 Magnitude?

James M. Major


October
November
December
SEPTEMBER
AUGUST
JULY
JANUARY
FEBRUARY
MARCH
DENER
CYGNUS
CASSIOPEIA
CERPHUS
LYEA
VEGA
PolARIS
CLUSTER
HERCULES
URSA-MAJOR
BOOTES
ARCTURUS
LEO
REGULUS
June
May
April

Investigating Motions in the Sky

Behavioral Objectives:

I. Student will learn to locate the North Star.

II. Student will be able to determine the latitude of his position by determining the altitude of the North Star above the horizon. He will determine the altitude of the North Star by using an astrolabe which he has made himself or by using materials provided by the teacher.

III. Student will have discovered that the stars and the earth move in relation to each other and will be able to describe this pattern of movement.

Materials:

Astrolabe
Mirror (At least 5 cm x 5 cm)
Plastic Hemisphere with cardboard base
Marking Crayon

Procedure:

Using the materials provided, find the North Star and plot its position on the transparent hemisphere. Then plot the positions of three other stars, one in the east, one in the south, and one in the west. Brighter stars will be easier to plot.

An hour later, repeat the procedure, plotting the positions of the same four stars. Try not to move the hemisphere, and the baseboard between observations. If possible, plot the positions of these stars a third, and even a fourth time.

Using the hemisphere with the positions plotted on it, answer the following questions:

1. In which direction did the stars move?
2. Did any of the positions of the stars shift in relation to each other? Explain.
3. How many degrees above the horizon was the North Star?
4. Where should you locate the position of the North Star marked on the transparent hemisphere in relation to the globe?
5. What is the relationship of the paths of the stars to latitude lines on the globe?

Dale Trentham

OUTDOOR EDUCATION CENTER FOR SOUTHERN ILLINOIS
SOUTHERN ILLINOIS UNIVERSITY

Campfire Song Sheet

WALTZING MATILDA (Australia)

Once a jolly swagman camped by a bill-a-bong,
under the shade of a collibah tree,
And he sang as he sat and waited while
his billy boiled,
"You'll come a-waltzing Matilda with me."

CHORUS
Waltzing Matilda, Waltzing Matilda,
You'll come a-waltzing Matilda with me,
(repeat last two lines of preceding verse)

Down came a jumback to drink at the billabong,
Up jumped the swagman and grabbed him with glee,
And he sang as he shoved the jumback in
his tuckerbag:
"You'll come a-waltzing Matilda with me."

Down came the squatter mounted on his
thoroughbred,
Up came the troopers, one, two, three,
"Whose that jolly jumback you've got in
your tuckerbag?
You'll come a-waltzing Matilda with me."
Up jumped the swagman, sprang into the
billabong,
"You'll never catch me alive." said he.
And his ghost may be heard as you pass
by the billabong:
"You'll come a-waltzing Matilda with me."

ALOUETTE (French - Canadian)

Alouette, gentille alouette,
Alouette, je te plumerai

1. (Leader) Je te plumerai la tete,
   (Group) Je te plumerai la tete,
   L. Et la tete, G. Et la tete,
   L. Alouette, G. Alouette,
   All: Oh. . .
2. Le Bec, 3. Le nez 4. Le doz
5. les pattes, 6. le cou

SWING LOW SWEET CHARIOT - (American)

Swing low, sweet chariot
Comin' for to carry me home.
Swing low, sweet chariot
Comin' for to carry me home.

I looked over Jordan and what did I
see
Comin' for to carry me home,
A band of angels comin' after me,
Comin' for to carry me home.

If you get there before I do, ...
Just tell my friends I' a comin'
there too. . .

BIMINI WOMAN (West Indies)

Haven't got a nickle, haven't got
a dime,
But my Bimini woman will be
waitin' there sometime,
And the ship is in the harbor
And the wind is out to sea.
And my Bimini woman will be watin'
there for me.

I'VE GOT SIXPENCE (England-sailors)

I've got sixpence, jolly, jolly
sixpence
I've got sixpence to last me all
my life
I've got tupence to spend
and tupence to lend
And tupence to take home to my wife,
Poor wife.
No cares have I to grieve me.
No pretty little girls to deceive me,
I'm happy as a lark, believe me,
As I go rolling, rolling home.
Rolling home, rolling home,
By the light of the silvery moon,
Oh, happy is the day when the sailor
gets his pay,
And he goes rolling, rolling home.

ZULU WARRIER - (South Africa - zululand)

Ai ku simba, simba, simba,
Ai ku simba, simba, zee. (Repeat both lines)
Hold him down you Zulu warrier,
Hold him down you Zulu chief. (Report both)

BILLY ADO (Malawi)
I'm telling a story of Billy Ado.
He was a man from Mexico.
He made songs of cow-a-boys,
and played on the piano. (Repeat verse)

He yonder this way and younder that way,
Ha, Ha, Ha, Ha strike again
And played on the piano (Repeat verse)

ASANI TA WERINGA (Malawi round)

Asani ta werings tiweringe,
Asani ta weringa tiweringe,
Tamawe namacheru,
Tamawe namacheru.

THIS OLD HAMMER (Americal Spiritual)
This old hammer killed John Henry,
(Repeat twice more)
But it won't kill me, no it won't kill me
This old hammer shines like silver. . .
But it rings like gold, yes it rings like gold.
Take this hammer to the captain.
Tell him I'm gone, tell him I'm gone.

If he asks you any questions. . .
Tell him you don't know
Tell him you don't know
(Repeat first verse.)

WHERE HAVE ALL THE FLOWERS GONE (America)
Where have all the flowers gone,
Long time passing,
Where have all the flowers gone,
Long time ago?
Where have all the flowers gone,
Girls have picked them everyone.

Where have all the young girls gone. . .
They've taken husbands everyone.

Where have all the young men gone. . .?
They are all in uniform.

Where have all the soldiers gone. . ?
Gone to the grave everyone.

Where have all the graveyards gone. . .?
Gone to flowers, one by one.

KOOKABURRA (Austrailian round)

Kookaburra sits on an old gum tree,
Merry, Merry king of the bush is he,
Laugh, kookaburra; laugh, kookaburra
Gay your life must be (haHa).

TZENA (Israel)
Tzena, tzena, tzena, tzena,
Can't you hear the music playing,
In the city square.
Tzena, Tzena, Tzena, Tzena,
Come where all our friends will find us,
With the dancers there.
Tzena, Tzena, join the celebration,
There'll be people there from every nation
Dawn will find us laughing in the sunlight
Dancing in the city square.
Tzena, tzena, come and dance the hora,
One, two, three, four, all the boys will envy me for,
Tzena, tzena, when the bank is playing,
My heart's saying Tzena, tzena, tzena.

CANOE SONG (American Indian)
My paddle's keen and bright, Flashing with silver,
Swift as the wild goose flies,
Dip, dip and swing.
Dip, dip and swing her back,
Flashing with silver,
Follow the wild goose flight.
Dip, Dip, and swing.

COCKOO (KUCHUCK) - (Austria)
Oh, I went to Peter's flowing spring
Where the water's so good
And I heard there the cockoo
As she called from the wood.

CHORUS Ho-li-ah,
Ho-li-rah-ku-ki-yah, ho-li-a-rah-Cockoo,
Ho-li-a-rah-ku-ki-yah, ho-li-a-rah Coc-koo,
Ho-li-a-rah-ku-ki-yah, ho-hi-a-rah-Cuc-koo.
Ho-li-a-rah-ku-ki-yah, ho.

KUM BA YAH (Angola-American)
Kum ba yah, my Lord, Kum ba yah.
Kum ba yah, my Lord, Kum ba yah.
Kum ba yah, my Lord, Kum ba yah.
Oh, Lord, Kum ba yah.

2. Some one's crying, Lord . . .

3. Singing . . .

4. Praying . . .

OLD TEXAS (American Western)

I'm going to leave old Texas now,
They've got no use for the longhorn cow.
They've plowed and fenced my cattle range
And the people there are all so strange,
I'll take my horse, I'll take my rope,
And hit that trail upon a lope.
Say adios to the Alamo,
And turn my head towards Mexico.

Language

Exercise: Sketch and Write

Purpose: To stimulate individual and group creativity in observing various aspects of their environment.

Materials: Sketch paper, notebook paper, pencil

Behavioral Objectives:

At the conclusion of this investigation the students will

A. have compiled a booklet on some aspect of nature

B. have developed a warm, working group relationship with the other members of their group

The teacher will subdivide the larger group into smaller groups of 6 or 8. Each individual will go into the field, woods, shore, or in some area to observe and sketch a natural scene. For 40 minutes, have the students go to various areas although they may be in the same group. Each student is to sketch a scene of nature. After 40 minutes, they are to return to their original group of 6 or 8. The group of 6 or 8 will compile their 6 or 8 sketches. Then each member will write a story or documentary concerning or related to their sketches.

Appropriate for grades 5, 8, 10

Keith Chapman
Rickie Hicks
Joe Milam
Shirley Menendez

OUTDOOR EDUCATION - Language and Social Studies

EXERCISE: Tombstones Tell All

The cemeteries in the Land Between the Lakes area reveal a great deal about the people who lived, worked, and died here. The actual wealth of information which can be obtained from the tombstones tells quite a bit to the careful observer By studying the markers, students can formulate ideas about how a person lived, what his life was like, and how he died. By combining the actual information on the markers with the imagination, the student can create a well-developed story.

Upon arrival at the cemetary, each student should select a tombstone which is of particular interest to him. The teacher can then ask a series of questions in order to aid the student in getting as many available facts as possible.

Suggested questions are:

(1) What is the full name of the person?

(2) Are there any other markers near by which have same name on them? Can you establish any relationships?

(3) When was the person born? When did he die?

(4) Were there any major events in history which occurred during his lifetime? Might any of these have affected his life or his death?

(5) Are there any particular emblems on the tombstones which tell you anything about the person (Masonic emblems, Woodmen of the World, Soldiers, etc.)?

(6) Is there anything unusual about the tombstone? Does it have an epitaph on it? Could there be any connection between this and other information you know about the person?

(7) Does the person's name "suggest" anything about his life? (Ex: Are there any men who have the last name "Farmer"?)

Tombstones Tell All (continued)

After the students have answered the questions, they should begin putting their story together. Ask them to base as much of their story as possible on actual facts. Any additional information can be made up, but should be worked in realistically with the actual facts.

Form and variation as to style, technique, and organization should be adapted to the level of the students.

Optional Activities:

1. In order to make a front page for their story, the students may want to make a "rub". They can place a piece of paper over the engraving on the tombstone and rub over it with a pencil or crayon so that the imprint appears on their paper.
2. Some students may wish to draw a picture of the person in the story.
3. Students who become very interested may wish to prusue a study of the family history of any family in this area. An excellent reference book is A Statistical Handbook of Trigg County by Eurie Pearl Neal, available at Paducah Tilghman Library and Carnegie Public Library.
4. As a classroom exercise, teachers may wish to examine similar techniques used by Edgar Lee Masters in Spoon River Anthology. As a classroom project, students may wish to compile a Land Between the Lakes Anthology.

Lynn Hodges
Sheryl Milam

OUTDOOR EDUCATION - LANGUAGE

EXERCISE: Keeping a Daily Diary or Log Book

The time spent at the Land Between the Lakes is, for most students, a time of many new and exciting experiences. The relating of these experiences to friends and family once they return home helps to keep the memory alive and makes the experience more meaningful each time it is related. However, since many of the students have never spent much time outside the city, they may have difficulty in describing an experience in a natural setting so that their exact perceptions, reactions, and emotions can be communicated to their listener.

The younger students may wish to record experiences each day with the boys keeping a "log book" and the girls keeping a "diary". This will give them a permanent and more accurate account of their experiences which they can take home with them.

The following should be emphasized in order to help them record their experiences just as they happened:

(1) Record your experience as soon as possible after it happens.

(2) Did you overlook any important details?

(3) Did the experience appeal to your senses? What did you see, hear, smell, taste, or feel?

(4) Will the person who reads or hears your description see it the same way you did?

(5) How did you react to the experience? Did you laugh, cry, jump up and down?

(6) Can you compare this to any experience you have ever had before?

(7) How many adjectives and adverbs have you used?

The data in the diary or log book may later be compiled into a longer composition. In this case, the teacher should stress coherence as the experience

Keeping A Daily Diary or Log Book (continued)

are combined into a single composition.

This exercise could be set up for a specific time or times each day that the student is at the Land Between the Lakes. He should be reminded, however, that he will have to record his experiences.

Lynn Hodges
Sheryl Milam

ENVIRONMENTAL EDUCATION

EXERCISE LANGUAGE: "Look Alike/Reminds Me of ________"

Behavioral Objectives:

At the end of this exercise the student will be able to do the following:

(1) Pick out phrases that are literal and figurative
(2) Write sentences that utilize literal and figurative phrases
(3) Utilize the technique of comparative language in speaking and writing

Procedure:

Take the group into a setting away from the Youth Center. Choose any spot that is natural and is of an area great enough to spread the students out in an isolated setting.

In order to gain the full attention of the group, begin by saying "Johnny is a pig. He eats too much." Ask the group if Johnny is really a "pig." They will answer "No." Ask them "why?" Many answers will be given, and full discussion should be encouraged. Summarize their answers by asking them to describe a pig, and then to describe Johnny, (any member of the group who will take the statement as a joke: Caution, do not hurt any feelings). After their descriptions, ask them why we often describe people by things that they are not.

(Tommy is a rat.)
(My teacher is a square.)
(She is a nut.)
(Jack eats like a horse.)

After the answers and discussion, explain that many times we describe things by comparing them to other things. When we do this we call it a "figure of speech" or figurative language. On the other hand if someone lived on a farm and had a pig and named it Johnny, then the statement, "Johnny is a pig.", would be a true statement. When we make a true statement, we describe it as a "literal" statement. Follow this up with examples that the other students can think of, making sure they identify their statement as literal or figurative.

Tell the students that writing can be much more fun if figurative language is used. Explain to them that they are going to write a sentence using figurative language. Instruct the students to find something they can hold in their hand. When all of the students find their object give them the following instructions:

A. Find a spot away from everyone else.
B. Sit down and look very carefully at their object.
C. Examine it as to its color, feel, smell (if any), and shape.
D. Fill in the following sentence, "my (the object) reminds me of (whatever it reminds of)
E. Do this as many times as they want, at least three.
F. Come back to the group meeting place.

When the group is assembled, tell them to simplify their sentences by crossing out the words "reminds me of" and put in the work "is". Tell them that their sentence is now a figurative sentence. Ask them "Why?" Once they give the correct answer, tell them that they are going to play a guessing game. They are only to read the last part of their sentences. Do not name their object. The other members of the group are to try to guess the object. when all who want to have participated, ask them to name the two types of descriptive sentences. (literal and figurative) Ask them to explain the differences. Tell them to give examples.

Some examples that the instructor of this exercise should expect to receive follow:

My rock is a blue mountain. (Description of slag)
My plant is the smell of root-beer on a summer day. (Description of sassafras smell)
My plant is a forest fire. (Description of "British Soldier" moss)
My rock is a cave of diamonds. (Description of a geode center)

The key to the success of this exercise is repetition, and the developing of significant relationships and images in the mind of the student. All of the sentences of the students should be kept by the student, as well as the object they are describing.

Follow up suggestions for classroom or campfire:

1. Since all of the students will not be in the same group the guessing game can be used in the class or in different groups.

2. When reading in class, have the students pick out figurative phrases.

3. Have the students compile a list of descriptive phrases used most often, and identify the phrases as either literal or figurative.

4. Have a writing exercise using figurative phrases describing something the class is studying in science (ie. stars), and

then follow it up with a literal description using scientific vocabulary.

5. Coordinate an art and English lesson by using figurative language to describe pictures drawn by the students. In conjunction with this the guessing game used in this exercise can be used to identify pictures.

This exercise is designed for elementary students, and can be conducted outside at the school or within a program of Environmental Education.

Cheryl Milam

Lynn Hodges

ENVIRONMENTAL EDUCATION: EXERCISE LANGUAGE

"HAIKU" - Analysis and Application of Natural Poetry

Behavioral Objectives:

At the end of this exercise the student will be able to do the following:

(1) Define "haiku"
(2) Pick out poems characteristic of the "haiku" effect
(3) Write a "haiku" image or poem

Procedure:

Due to the form and content of Haiku poetry, it is in direct correspondence with nature. Haiku is Japanese poetry, however it is a unique and versatile art form in any language. The Japanese have strict rules about writing haiku poetry.

(1) The poem must refer to nature.
(2) It must represent or have referance to a season.
(3) It has only three lines.
(4) The first and last lines have five syllables, and the middle has seven, for a total of seventeen syllables.

For this exercise, the student may try for a true haiku by following the above rules, or he may simply try for a haiku effect or image. The instructor in this exercise should explain that haiku (pronounced: high-ah-kool is very special because it is the only form of poetry dedicated entirely to nature, and the beauties of nature. The writer of a haiku must become a part of this natural relationship before writing, consequently most haiku is written out of doors, away from the pressures and influence of a "concrete" society. Rhyme and meter are insignificant as the total purpose is to reflect the natural image.

It is necessary that the instructor in this exercise get the group away from other groups, and away from each other if possible. Each student should be encouraged to write a haiku poem or image by himself. Encourage them to be creative and original. Emphasize the idea that they are a part of nature, they are in nature, and all they have to do is to describe the natural feelings they have.

"HAIKU" - Natural Poetry
(Form #1)

Rules:

1. Refer to nature
2. Describe or refer to a season
3. Have only three lines
4. Line one = five syllables
   Line two = seven syllables
   Line three = five syllables

   TOTAL = seventeen syllables
5. Forget rhyme and meter

Write your "haiku" below. Relax, take your time, and be NATURAL!

"Haiku" - Examples of haiku poetry and images
(Supplement to exercise)

In the falling snow
A laughing boy holds out his palms
Until they are white

Richard Wright----- ____________________ 1.

I am nobody
A red sinking autumn sun
Took my name away

Richard Wright----- ____________________ 2.

Firefly-
By daylight
An insect with a red neck

Basho----- ____________________ 3.

Flowers on a stem
Do not always blossom full
But thought never dies

Nancy Malisan----- ____________________ 4.

I'm a new born tree,
My life has hardly begun,
I hope it will last. 5.

Sue Barrett----- ____________________

Beautiful rainbows
Painted neatly in the sky
After spring showers 6.

Rosalind Polanowski-- ____________________

Suggested exercises for Campfire or Classroom:

1. Compare the "haiku" poetry to traditional English poetry.
2. Obtain several works of Japanese paintings, and discuss the relationships between the poetic art and the graphic art forms.
3. Read the students' "haiku" before the groups, keeping the name of the authors anonymous if they wish.
4. Compose an anthology of "haiku" poetry as a class or individual project.
5. Have artistically gifted students draw or paint pictures using "haiku" as their subject.

Some students will find it difficult to conform to the Japanese rules of haiku, consequently they should try for a haiku image which reflects their feeling about nature or life in general. Ask them to keep the haiku form of three lines.

For all of the students tell them to not begin writing immediately. Give themselves time to become aware of their surroundings and the effect these surroundings have on them. When they become aware of these things, write about it.

It will help the instructor as well as the students to have a prepared sheet (attached form #1) giving a summary of the rules of haiku.

At the end of the exercise, allow those students who wish to read their poems or images. Have discussion on those that are especially expressive or unique.

NOTE: This exercise is designed for a Secondary Level of Instruction, and should be conducted outside.

Lynn Hodges

ENVIRONMENTAL EDUCATION

Exercise: Language and Social Science (Designed for use on elementary level)

"Words Are Symbols"

BEHAVIORAL OBJECTIVES:

At the end of this exercise the student will be able to identify symbols as used in literature, and will be able to write and explain the symbolic significance of at least three symbols.

> "What's in a name? A rose by any other name would smell as sweet."
> Romeo and Juliet-Wm. Shakespere

We live in a world of symbols. All forms of language are symbolic. Words, in any language, are simply verbal and graphic symbols. The word spelled TREE is only the name or symbol we attach to the living plant. The reason we can use this symbol is that we all have a mental picture of the plant. If this were not true it would be impossible to communicate. Therefore, we can make up or invent our own symbols, and, if we all know what the symbols mean, we can communicate. On a simple level we can invent our own language.

PROCEDURE:

The exercise should be conducted in a group. Explain to them about symbols, and that words are symbols. Emphasize that we do not think in words, but we think in pictures. Mental images are the pictures we receive when we hear or see the symbol. Examples of symbols other words can be given. (Stop signs, Stars on the American flag, and Grades on Report Cards.) Ask for other examples from the group.

When the idea of symbols is established, suggest the idea of inventing a new or "secret" language. For this exercise to be successful, enthusiasm and a certain degree of secrecy is required. The secrecy is to keep an idea of fun and apprehension in the minds of the children. Each group can use the "new language" with anyone else, but they cannot tell others what the "new symbols" represent.

From this point on, the students should be told to use only the "new language" or the "L.B.L. Secret Language". Instead of the regular words, tell the students that, for the rest of the time at L.B.L., we'll use the following symbols:

Tree-to be called "grok"
Deer-to be called "bock"
Water-to be called "drup"

A sentence in the L.B.L. language would be: The bock jumped the fence, ran behind the grok and fell into the drup.

Repetition is the key to the success of this exercise. The students must memorize the three words and use them in several sentences during and after the exercise. When in camp, they will use the "new words" with the other children. Some will know the meaning and others will not, depending on whether or not their group has had this exercise. The use of the new words, the symbolic words, will create a spirit of mystery and secercy among the students. If conducted properly, this element of mystery will be one of the highlights of the trip, and be condusive to remembering the exercise and its meaning.

By the end of the session, all groups should know the "new language". After the trip to L.B.L., they should continue to use the "new language" with friends, parents, ect., and by association will remember the symbolic use of words for communication.

Sheryl Milam

Lynn Hodges

ENVIRONMENTAL EDUCATION:LANGUAGE

Is there an English teacher who does not think of a quotation from Shakespere to apply to almost everything? I am no exception. My first thoughts in connection with literature and the outdoors are of Shakespeare's As You Like It. If I remember correctly, the good king and his court were banished from their life of luxury to the forest by a usurper, a wicked brother. After a few months of living with nature, one of the characters quoted these lines:

> Sweet are the uses of adversity which, like the toad, ugly and venomous, wears yet a precious jewel in its crown. And this, our life, exempt from public haunt, finds tongues in trees, books in the running brooks, sermons in stones, and good in everything. I would not change it.

I should like to help students find "tongues in trees, books in the running brooks, sermons in stones, and good in everything."

Approximately 98% of my students in ninth-grade English this past year wrote of death, violence, destruction, and corruption. Somewhere, somehow, some young people have lost the feeling for many good things in the world. One of these is the true feeling of beauty in nature. Instead of a flower symbolizing a hippie movement, I should like to help young students see the true beauty of the creation of God - - to see, touch, smell the beauties in nature.

To say that I would like to help students communicate with nature may sound more like William C. Bryant than Ben A. Clift; therefore, I shall say that I would like to help students improve communication by living with nature.

I shall leave the study, the classification and name-calling of plants, animals, birds, stars, and rocks to the botanist, the biologist, the geologist, and the astronomist. My major concern will be to help students see, touch, taste, and smell the wonders of the outdoors. There are, I believe, many opportunities to correlate outdoor education with the teaching of English and literature in a ninth-grade English class

Objectives

Some professionals have stated the broad objectives of outdoor education in the following way:

> The preservation and development of both the individual and society demand that every normal individual develop the abilities and characteristics essential to effective social living in a democracy. These abilities and characteristics translated into aims may be stated as:
>
> 1. The objective of Self-Realization
> 2. The objective of Human Relationship
> 3. The objective of Economic Efficiency
> 4. The objective of Civic Responsibility[1]

My particular interest will fall under the category of self-realization in which the student learns to apply language arts activities, grammar and literature, to life situations in the outdoors by gaining an understanding of man's relation to the total universe and by exploring new avenues of individual creativity stimulated by beauty of the outdoors.

Some other broad objectives developed by various school systems around the country and myself are:

1. To develop a sense of moral and spiritual aesthetic values

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[1] Smith, Carlson, Donaldson, Masters, Outdoor Education, Prentice-Hall, Inc., Englewood Cliffs, N. J., 1963, p. 30.

2. To have a good time
3. To teach citizenship
4. To teach worthy use of leisure time
5. To keep physically fit
6. To increase understandings and appreciations
7. To learn to assume responsibilities
8. To learn how to live in the out-of-doors
9. To develop a friendly, informal atmosphere of learning
10. To create interests and hobbies by using natural resources
11. To encourage growth and individual personalities

Specific Objectives: My major specific objective will be to create a better narrative.

Behavioral Objectives:

1. To listen and respond
2. To practice using the figures of speech
    - a. similie
    - b. metaphor
    - c. personification
    - d. alliteration
    - e. onomatopoeia
3. To increase vocabulary
4. To use a descriptive verb in the active voice and to be more concrete in writing
5. To create a better narrative

Input

I. Financing: If the school board does not finance the outdoor education program, families should assume the food costs of the pupils. However, if the family is financially unable, regular social agencies which normally take care of this should assist. Local service clubs and organizations might help. The school will probably assume the cost of transportation and the state or Federal Government will supply the recreational area.

II. Time: My project is planned for two and a half days.

III. Counselors: My requirement for camp counselors will be any school teacher who has a genuine love for children and a genuine love for the outdoors.

Process

I. Listening and responding activities

I shall select various spots in the area and send groups of three or four students to the different places for forty-five minutes or an hour. The pupils will sit quietly with their eyes closed for short intervals and jot down words which describe the various sounds they hear. I shall encourage them to think how to describe a certain bird's call, a frog's sound, the sound of feet on a path, the sound of water hitting the shore, the buzz of the bee, etc. They will be encouraged to use fresh, new words. Emphasize: If you have heard it before, don't use it.

After the exercise, we shall have a meeting of all groups to see how many different impressions of the same sounds were received.

This exercise will be repeated for night sounds and an individual list of words will be kept of both day and night sounds to be used in the next exercise.

II. Exercise in using the figures of speech

Students have been introduced to some figures of speech in grades five through eight. I shall, of course, review and teach similie, metaphor, personification, alliteration and onomatopoeia in the classroom before moving to the outdoors.

Some examples:

Similie: The deer darted into the forest like a fugitive from justice.

Metaphor: The hoot of the owl was a fog horn warning us of an approaching danger.

Personification: The wild flowers laughed and danced in the summer breeze.

Illiteration: The bobolink bobbled on the birch.

Onomatopoeia: The lightening zig-zagged through the jet black sky.

Again, students will be taken into the forest where they will observe insects, animals, flowers, the clouds, the grass, etc. Here, they are to create figures of speech. They may refer to the list of words compiled in the previous exercise.

III. To increase vocabulary

Students will keep a notebook of vocabulary words during the entire stay in the out-of-doors. They will check the correct spelling and pronunciation in the dictionary and encouraged to use these words in speaking and writing.

IV. To use descriptive verbs in the active voice and to be more concrete in writing.

I shall teach the difference between an active and a passive voice verb. When the subject of the sentence does the acting and carries the action from the doer (subject) to a receiver (the direct object of the verb), the verb is in active voice Example: The wind blew the dead leaves. Wind is the subject (the doer) carrying the action to the leaves (the receiver of the action) The verb blew is said to be an active voice verb.

When the subject of the sentence is acted upon, the verb is in passive voice Example: The dead leaves were blown by the wind In this sentence the subject (leaves) is acted upon The important word in the sentence (wind) is tucked away in a relative unimportant grammatical construction at the end of the sentence

Emphasize: (1) An active voice verb shows more action than the passive voice verb. (2) It takes fewer words to express an idea in the active voice (3) The active voice thrusts the action into the reader's mind and stimulates more interest

In an outdoor setting students will write a paragraph describing the actions of an animal, an insect, or a bird They will be asked to recall any sound words, figures of speech, or vocabulary words used in the previous activities. After completing the paragraph, they will revise it by changing all passive voice verbs to active voice

I shall stimulate the use of good descriptive action verbs by pointing out some action in the outdoor setting. Instead of saying, "The deer went across the field", I shall encourage students to be more concrete and to think how the deer went across the field and to substitute a colorful verb for went.

Examples:

1. The buck bolted across the meadow
2. The buck sprang across the pasture.
3. The fawn limped across the meadow.
4. The doe darted across the field.
5. The doe shot across the pasture.

This exercise could be applied to any action observed in the out-of-doors.

V. To create a narrative

Inspiration for a complete narrative may be gained from any of the activities experienced so far. However, to add more variety to the experiences, we shall take trips to the old, abandon farm houses, the Center Furnace, the cemeteries, the aquatic ponds, and the lakes. I shall be able to give students bits of information on these points of interest which will lead them to an idea for the creation of a good story.

VI. Some evening activities which will help accomplish goals are:

- a. Games
    - 1. Charades
    - 2. A game following trail signs
    - 3. Nature scavenger hunts
    - 4. Nature challenges
    - 5. A Nature spelling bee
    - 6. Nature Relay
    - 7. Twenty Questions
- b. Singing
- c. Story Telling

Outcomes and Evaluation

I shall have an excellent opportunity to evaluate my program and to follow up on classroom activities. I shall expect more creativity in all writing, more freedom in expression of thoughts and emotions. The outdoor experiences will sharpen the senses--the ability to feel and observe the smells, sights, sounds, touch, and taste, and to express these feelings and observations in writing.

Some evaluation questions to determine behavioral objectives outcomes are:

1. What changes in writing habits have you noticed?
2. What vocabulary gains have you noticed?
3. Do students use colorful original figures of speech?
4. Do students use descriptive verbs in the active voice?
5. Do students create a better narrative?

Ben Clift

Art Exercises: NATURE PRINTS

Behavioral Objectives:

After completing these exercises, the student should be able to:

1. Construct several different kinds of nature prints for display or collections.

2. Identify and name various types of nature prints from materials used.

3. Demonstrate an awareness of the beauty of shapes and texture in nature.

I. Exercise: Spider Web Prints

Materials Needed:

Dark-colored construction paper
Can of white enamel spray paint
Scissors
Can of plastic spray or hair spray (Optional)

Procedure:

Locate spider web and gently persuade spider to move off web if one is there as you won't want to kill it.

Spray the web lightly with paint on both sides, with the breeze if there is any. DO NOT attempt this exercise on a windy day.

When all parts of the web have been sprayed, ease paper close to the underside or back of web. Try to touch paper to all parts of the web at once. Keep paper steady as pulling or twisting will destroy the web. As soon as the web is stuck to the paper, cut the guy lines at the edges of the paper very carefully. Put on flat surface to dry.

For permanent mounts, spray the entire paper with plastic spray to preserve the print. Hair spray may be used for this.

These prints are beautiful when framed. Attractive prints may also be made by using b lack spray paint and white paint.

II. Exercise: Spore Prints

Materials Needed:

Mushroom cap
Light-colored paper
Gum arabic or glue
Glass or plastic dish

Procedure:

In this exercise, the gungus actually prints itself. To make the spore print, cut the mushroom from its stem close to the gills.

Coat hard-surfaced sheets of paper with glue and place the mushroom cap, rounded side up, gill side down, upon the paper and cover with a glass dish.

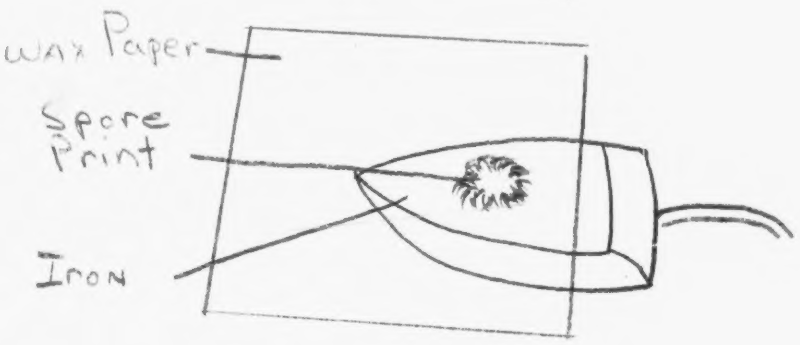
Let the mushroom stand for a while, overnight if possible, making sure not to move it while the spores are dropping onto the paper. If it is not disturbed, an exact print of the underside of the mushroom should occur.

OR:

Spore prints may be made with wax paper if an electric iron is available.

Materials Needed:

- Mushroom cap
- Wax paper
- Electric iron
- Glass dish
- Construction paper



Procedure:

Use same directions as above except place the mushroom cap on wax paper and cover with glass dish.

After spore print has set, to make it permanent, heat wax paper with electric iron set on low. Turn iron, warm flat side up and place underside of wax paper on iron. The spores will settle into the melting wax. The print may then be mounted on colored construction paper for contrast.

III. Exercise: Blueprints

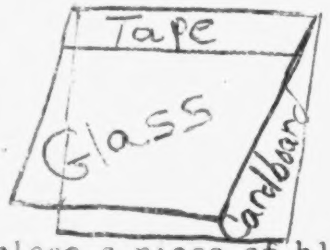
Materials Needed:

- Ozite paper (high speed blueprint paper)
- Piece of glass with smooth edges (window pane may be used)
- Cardboard same size as glass
- Small jar filled with ammonia (covered until needed)
- Large covered jar or container
- Fern, plant, leaf or other flat object to be printed
- Masking tape

Procedure:

Make a printing frame by placing the glass upon a piece of cardboard the same size as the glass. Hinge them together at the top with masking tape.

Printing Frame



To print, lift glass cover and place a piece of blueprint paper, treated side up, on the cardboard. Put leaf or other object to be printed on top of the paper and lower the glass. Expose to sunlight until paper becomes white.

Remove paper from frame and place in large covered container filled with ammonia fumes. This is achieved by placing a small uncovered jar of ammonia inside the large container. Leave prints inside the large container for about five minutes or until print is set. This step of the exercise should be done under the direct supervision of an adult.

NOTE: Be sure to keep blueprint paper stored in heavy envelope or other light free container as the paper will be ruined if exposed to light.

IV. Exercise: Smoke Prints

Materials Needed:

- Candle
- Matches
- Lard or other type of shortening
- Typing paper
- Leaf
- Newspaper (Optional)

Procedure:

Take a sheet of typing paper and grease the surface lightly with a little lard. Light candle and smoke greased paper by moving it quickly back and forth over the flame.

When the surface is black with soot, place soot side of paper up and put leaf, vein side down, on the blackened surface. Cover leaf with another piece of paper (newspaper would do for this or use another piece of typing paper) and rub until every part of the leaf is inked throughly with soot and grease.

Lift leaf and place inked side down on a clean piece of typing paper. Cover with another piece of paper (any kind) and rub the entire leaf. Be very careful not to move the leaf as this will blur the print. When every part of the leaf has been carefully rubbed, remove and discard the top paper and leaf.

This is one of the most primitive methods of printing and results in a delicate etching-like print.

V. Exercise: Leaf Stencil (To be used in connection with smoke prints)

Materials Needed:

Same as above for smoke prints plus
Scissors
Watercolors and brushes

Procedure:

For accurate and colorful prints, make two smoke prints of each leaf to be stenciled. Cut out carefully along the outline of one leaf print. The remaining part of the paper forms the stencil of a leaf. Place the stencil over the other smoke print, matching the leaf outline exactly and paint with water colors.

This gives a very realistic leaf print.

VI. Exercise: Ink Prints

Materials Needed:

Ink pad
Leaf
Paper (typing or construction)
Roller (Optional)

Procedure:

Place leaf on ink pad, vein side down, and press until every part of the leaf is inked. Then place leaf on paper and rub throughly to make imprint. It is best to place another piece of paper on top of the leaf before rubbing as it is less messy this way.

OR: Instead of placing leaf on ink pad, a roller may be inked and rolled over leaf before leaf is pressed onto the paper.

Ink printing results in strong clear prints suitable for framing if printed on construction paper.

VII. Exercise: Leaf Silhouettes

Materials Needed:

Small piece of sponge
Ink pad
Leaf
Paper

Procedure:

Press sponge on ink pad and throughly ink. Hold leaf on paper and rub sponge all around edge of leaf using outward motions onto paper. Remove leaf and there will be an outline of the leaf on the paper.

This is an easy method to use when only the shape of the leaf is needed.

VIII. Exercise: Crayon Prints

Materials Needed:

Crayons
Live leaves
Typing paper

Procedure:

Place leaf, vein side up, on a flat surface. Place paper over leaf and rub with crayon where the outline of the leaf can be seen. Then rub the entire leaf. The edges and veins of the leaf will soon appear on the paper.

A combination of colors may be used to show the effect of an autumn leaf if desired. A hazy effect may be achieved by removing the paper from the crayon and rubbing with the side of the crayon.

This is a very simple technique for printing but is good for showing the various shapes and veining of leaves.

IX. Exercise: Sun Prints

Materials Needed:

Colored construction paper
Leaves
Pins or small rocks

Procedure:

Pin leaves to construction paper or hold down with small rocks and place in bright sunlight. Let leaves remain in sun for an hour or longer. Remove leaves and find outlines on the paper.

This is a very simple lesson to show that light fades color and is a simple method to use when only the shape of the leaf is needed.

X. Exercise: Spatter Prints

Materials Needed:

Tempera paint, ink or Shoe Polish
Old toothbrushes
Small pieces of wire screen
or small stick
Leaves
Pins or small rocks

Procedure:

Pin leaf or leaves to paper or hold down with small rocks. Dip toothbrush in paint, ink or shoe polish and rub over screen until entire paper is covered with spatterings. If screen is not available, the same effect may be achieved by drawing a small stick or your finger along the bristles of the brush. (Motions of stick or finger should be toward you.)

When desired amount of spattering is achieved, remove leaf to find leaf outline standing out in the midst of the spatter.

This technique can also be done simply by using a can of spray paint

XI. Exercise: Tempera Leaf Prints

Materials Needed:

Powdered Tempera Paint
Water
Container for mixing
Leaf
Paper
Brush (Optional)

Procedure:

Mix a small amount of powdered tempera paint with water and pour or brush mixture onto paper. Place leaf, vein side down, on paint. Put another piece of paper on top of the leaf and rub all parts throughly.

Remove leaf and place, vein side down, on a fresh piece of paper on which leaf is to be printed. Once again, put another piece of paper on top of the leaf and rub. A colored leaf print will result.

Different parts of the leaf may be pressed into different colored tempera to make prints of autumn leaves changing colors.

SHOE POLISH can also be used successfully with this technique.

XII. Exercise: Waxing Leaves

Materials Needed:

Candle or paraffin
Container for melting paraffin
Hot plate
Electric iron
Wax paper
Liquid Floor Wax
Flat dish
Clear contact paper
Cardboard

(NOTE: Not all materials are needed for each procedure.)

Procedure:

Here are a few simple methods for preserving leaves for display or collections.

1. Rub some paraffin or a candle on the bottom of an iron and press both sides of leaf with iron.

2. Melt paraffin in container and dip leaf into it. Allow to harden.

3. Pour some liquid floor wax in a flat dish. Dip leaf into it and hang up to dry.

4. Place leaves between pieces of wax paper and press with iron.

5. Place leaf onpiece of tagboard or other light piece of cardboard and cover with clear contact paper.

XIII. Exercise: Leaf Print in Plaster of Paris

Materials Needed:

Small paper dish or lid from oatmeal box, ect. for mold
Plaster of Paris
Water
Container for mixing plaster
Leaf small enough to fit in mold
Paint - tempera or water color (Optional)
Hairpins (Optional)
Varnish (Optional)
Vaseline or lard

Procedure:

Grease inside of mold and also grease leaf to be used. Place leaf, vein side up, in the bottom of the mold.

Mix plaster by adding plaster to the water, a small amount at a time. It is ready for use when the plaster mixture is about the consistency of whipped cream.

Pour into mold--start by carefully dropping plaster in the center of the leaf. Do this carefully so that no plaster gets under the leaf, then finish filling mold.

If this print is to be used as a plaque to hang, make a hook by putting a hairpin into the top of the cast before it hardens.

When the cast is dry, take out of mold and remove leaf. Wash cast gently to remove grease The leaf part of the cast may be painted at this time The print shows veining and texture of the leaf

OR: The leaf may be left in place and a clear coat of varnish applied to preserve the actual leaf. It is wise to use more than one coat of varnish if this procedure is followed.

The cast may be used as a paperweight if a hook was not inserted for hanging

Jane McBride

Art Exercises: SKETCHING AND PAINTING FROM NATURE

Behavioral Objectives:

Following these exercises, the student should be able to:

1. Construct an art composition with out the aid of commercial materials.
2. Name various methods of obtaining natural colors.
3. Develop an appreciation for the ingenuity of the people of yesteryear.

I. Exercise: Charcoal Sketching

Materials Needed:

Drawing paper
Large pieces of cardboard on which paper is to be taped or clipped (one for each member in group)
Masking tape or clips

Procedure:

Plan this activity on a day following a campfire session. Give each person a piece of paper fastened to clipboard (cardboard) and take group to campfire site On the way to the site, let students wonder what they will use for drawing since the instructor obviously has no materials along either. The instructor might take along some bread as this makes an excellent eraser for charcoal and also adds to the suspense as to what the students will be doing for this exercise. At the camp site, let someone bring forth the idea of using charcoal from last night's campfire for sketching.

Students are usually quite enthusiastic about this project and come up with excellent sketches of scenes around them.

II. Exercise: Painting with Nature's Paints

Materials Needed:

Drawing Paper
Large pieces of cardboard on which paper is to be taped or clipped (one for each member in group)
Masking tape or clips

Procedure:

Take group to some area away from "civilization". Hand each person a piece of drawing paper fastened to a clipboard (cardboard) and ask him to paint a picture. This will bring forth such questions as, "Paint with what?" and "What will I use for a brush?"

Suggest that nature is full of color and with a little effort we can find natural dyes such as the natives of long ago used. Also we can find ways to get our colors onto the paper. Students are usually fascinated by this idea and set to work immediately.

Some will use fingers, others may make brushes from twigs, ect. It doesn't take long to discover that by mashing berries, squeezing leaves, grasses or flowers, using dirt or clay, marking with rocks, ect. We can truly paint from nature.

A variety of paintings usually result from this procedure.

As a follow-up to the exercise, a discussion may disclose what colors resulted from the various experimentations such as purple from poke berries, red or pink from other berries or blossoms of flowers, brown from dirt or clay, green from squeezing grass or leaves, yellow from goldenrods, and many, many others.

Jane McBride

Art Exercise: NATURE COLLAGE

Behavioral Objectives: After this exercise has been completed, the student should be able to:

1. Tell what a collage is.

2. Construct any sort of collage.

3. Demonstrate an awareness of the beauty of nature objects.

4. Develop an awareness of the need for conservation.

Materials Needed:

Pieces of thin wood, tagboard, cardboard or other fairly heavy material to be used for mounting nature objects (1 for each person in group)
Glue
Burlap

Procedure:

Discuss what a collage is - a picture or art composition produced by combining and pasting "odds and ends" to a background. The collage may or may not convey a message.

After discussion, send students on short search for nature objects to be used for collages. Be sure to stress conservation before the nature walk begins. Remind students not to take live bark from trees or to take more of anything than is needed. Discuss reasons for using objects already on the ground when possible, ect.

The collage may be strictly creative without any guidance given as to what to look for - may use a combination of any nature objects or specific instructions may be given such as:

Look for shapes and forms in nature.

Make a leaf collage.

Try to find as many things as possible to illustrate various phases of nature - a feather to represent birds, a bone or piece of fur to represent mammals, a deciduous leaf, an evergreen twig, ect.

Nature objects may be mounted in any way the student desires on the backgrounds provided. The collages are especially effective when the wood or cardboard is first covered with burlap but this is not necessary.

Jane McBride

RECREATION

Exercise: The ABC Nature Scavenger Hunt

Purpose: To provide an activity for recreation and working together in a group.

Behavioral Objectives: At the conclusion of this exercise, the student will be able to:

1. Recognize and identify items on their list.
2. Order the items they have collected.
3. Operate as a team.
4. Accomplish the task in a given length of time.

Materials: A hand-out for each student of a list of items each group is to look for. This list might include:

A - Acorn, ant
B - bug, bark
C - cricket, clay
D - drift wood, droppings (any animal)
E - evergreen branch
F - frog, fur(any animal)
G - grasshopper
H - huckleberry
I - insect
J - Jaybird feather
K - kindling
L - leaf, lichen
M - mushroom, moss
N - nut, nest
O - oatgrass, onion (wild)
P - pokeberry, poison ivy
Q - quill (flight feather of a bird)
R - root, rod (straight stick)
S - slate, snake skin
T - thorn, tent caterpillar
U - underbrush
V - vine, volcanic rock
W - walnut, web
X - Xmas tree branch
Y - young butterfly (caterpillar)
Z - zinc colored rock

Procedure: Divide the group into teams and assign a leader to each team. Designate at what time each team is to return from the hunt. When all teams have returned, have the leaders make a tally of the items their group was able to find. The group that found the most items on the list is designated as the winner.

Sherry Shoemaker

Readiness For The Future

Man in his first existence had to learn how to survive the natural elements. This art of survival has to a large degree been forsaken as man has evolved to the supposedly higher level of living.

The question arises in my mind, with our present environmental crisis, could a group of young people cast in a similiar situation as early man survive?

Procedure For Survival

I. General Instructions
    A. Safety precautions
    B. Time span - two days
    C. Starting point anywhere
    D. Destination - Group decision
    E. Formation of families

II. Specific Instructions
    A. Locating favorable conditions
        1. Water
        2. Building materials
            a. dead trees
            b. young saplings
            c. grasses
            d. mud
            e. stones
        3. Protection
        4. Construction of a shelter
            a. Log cabin
            b. Lean-to
            c. Grass hut
            d. Tree house
            e. Houseboat
        5. Construction of furnishings
            a. Bed
            b. Chairs
            c. Table
            d. Dishes
            e. Wooden utensils
            f. Cooking facilities
        6. Construction of a bridge
        7. Construction of Water Transportation
        8. Location of food sources
            a. Wildlife
                1. traps
                2. hunting weapons
                3. fishing equipment
            b. Vegetation
                1. berries
                2. roots
                3. bark
                4. fruit
                5. mushrooms
                6. bulb plants
            c. Insects

B. Equipment
  1. Travel
    a. compass
    b. maps
  2. Building tools
    a. hatchets
    b. files
    c. knives
    d. shovels
    e. buckets
    f. chisels
  3. Medical supplies
    a. First aid kit
    b. First aid manual
C. Formation of Township
  1. Establishment of family identity
    a. Immediate family--maximum number-5
      1. Father
      2. Mother
      3. Son
      4. Aunt
      5. Uncle
    b. no hired help
  2. Establishment of local government
    a. Town leader
    b. Council
    c. Laws
    d. Tom historian
  3. Establishment of Currency
    a. Banker
    b. Bank
    c. Types of currency
      1. Any fossil worth $1.00
      2. Geode worth $5.00

This is only an outline. Each group planning this type of project must work out the details with the students involved. It does work.

Bob Farmer

PRIMARY GRADE ONE DAY FIELD TRIP

Field Trip with 6 year olds to LBL to explore wooded area and visit Educational Farm.

Trip to be made by school bus. Leave school approximately 9:00 a.m. - back by 3:00 or 3:30 P.M. Take lunch.

Teacher, teacher aide, plus one other qualified person. Leaders tagged by color (3 different colors). Children tagged by name and color (responsible to one of the three leaders by color).

Wooded area to be checked out beforehand by teacher so she is familiar with the area and is sure this particular area suits the needs of the class.

Trip hopefully to be made in the fall so children can early be made aware of "outdoor education" and so that certain things may be brought back to the classroom to be observed throughout the school year and others may become the basis for further study and investigation.

Several activities planned for small children but schedule very flexible in order to take advantage of "most opportune learning situations".

OBJECTIVES

1. To develop awareness for the role played by each of the five senses in the identification of things around us.
    a. Identify objects by using several of the senses and state which sense or senses were used to make the identification.
    b. Identify likenesses and differences through visual examination.
    c. Develop power of identification through the sense of touch or smell.
    d. Develop skill in identifying objects by the sounds they make.
2. To develop skill in observation and classification.
    a. Classify living things into two categories - animals and plants.
    b. Classify objects according to their characteristics.
    c. Construct a classification of objects according to one specific characteristic and describe the characteristic chosen for the method of classification.
    d. State the color, shape and size of various objects.
3. To develop greater interest in all kinds of animals.
    a. Distinguish one animal from another using the senses as the only source of information.
    b. State how some common animals are similar and how they are different.
    c. Identify and name various animals found on a farm.
    d. Identify and name various animals found in the woods.
    e. Identify certain animals by the sounds that they make.
    f. Construct a classification of animals on the basis of physical or behavioral characteristics.

ACTIVITIES

1. Upon arriving at destination, each child assigned small area to investigate. Through use of the senses, he is to find out all he can about his area in a short length of time. Stress - since it is not always safe to taste, we will not use that sense very often on this trip.

2. Smell along the trail.

    a. Sniff like a bunny.
    b. Crush leaves to smell.
    c. Smell handful of soil, etc.

3. Feel along the trail.

    a. Feel texture of tree trunks.
    b. Feel leaves, rocks, blade of grass, etc.
    c. Close eyes occasionally to feel things.

4. Stop ever so often - still as a mouse - to listen for about a minute. (Use often throughout nature walk.)

5. Use "seeing eyes" to:

    a. Look for animals.
    b. Look for animal homes.
    c. Look for animal tracks. (Make plaster cast of at least one animal track to take back to classroom.)

6. Make nature collection.

    a. Collect leaves (for classifying, leaf collection and use in art work).
    b. Collect other objects of interest for use in setting up Nature Table and for further observation under "giant magnifier".

7. Observe plant life.

    a. Note effect of sunlight and shade on plants.
    b. Especially note mosses, ferns and lichens.
    c. Take mosses and certain other plants back to classroom to find out more about them and to make a terrarium.

8. Visit a pond.

   a. Observe pond life - name things seen.
   b. Take back pond water to observe "pond life" under magnifier. Teacher to supplement this activity either before or after trip to get adequate materials for setting up an aquatic pond in the classroom.

9. Observe a stream

   a. Name things seen in stream.
   b. Note reflections and shadows.
   c. Drop leaf in stream and watch float downstream. Note waves or ripples made when thrown in.
   d. Stir up water with stick. Note what happens to water.
   e. Take temperature of air and that of water. Note difference.

10. Occasionally look under rock or logs. (Adults to do this - children observe. Stress importance of replacing things as found.) Examine rotting log.

11. Look for spider webs. Mount one for classroom collection.

Rest, talk about experiences, play restful games, eat lunch. Stress - no littering.

Visit Educational Farm.

Educational Farm

1. Animals
    a. Name of each.
    b. Observe size, color, etc.
    c. Pet or hold if possible.
    d. Listen for sound each makes.
    e. Talk about what is seen, heard, felt or smelled about the animals.
    f. Find out about the care of each.
    g. Feed if possible or watch as they are being fed.
    h. Find out main use or value of each.

2. Garden and Fields
    a. Observe crops.
    b. Find out what plants are grown on the farm.
    c. Find out that we eat various parts of plants.
    d. Get samples to take home if possible (pumpkin, etc.)
    e. Get some soil to take back to classroom.

3. Farm Buildings
    a. Name of each.
    b. Use of each.

4. Farm Machinery
    a. Name of each.
    b. Use of each.
    c. Watch in operation if possible.

Correlation with various subjects
and/or
Follow-up in the classroom

Language Arts

1. Write stories of experiences "on the trail" or on the farm.
2. Listen to appropriate stories.
3. Story Telling.
4. "Think of" or write list of nature objects for i/t/a sounds. (n-nut, l-leaf, etc.)
5. Pretend you are one of the farm animals (or squirrel, etc.). Tell us about yourself.
6. Compose poems.
7. Listen to poetry - many appropriate one in "Poems to Grow On", (Jean McKee Thompson - Beacon Press)

Social Studies - Pursue study of farm life.

Science

1. Make aquatic pond in classroom.
2. Set up Nature Table.
3. Make glass jar terrarium.
4. Use of magnifier for closer observation of objects brought back from field trip.
5. Classify leaves by color, size or shape. (Also nuts rocks, etc. may be classified.)
6. Classify animals seen - may use pictures.
7. Begin leaf collection (press between waxed paper).
8. Plant different kinds of seeds.
9. Further study of animal homes. (Collect real ones when possible such as bird nest, construct models, find pictures.)

Mathematics

1. Identify shapes in nature. (This leaf is shaped like a ____________?) (rock, sun, tree, etc.)

2. Talley certain things seen.
3. Locate direction - north, east, south, west.

Art

1. Leaf prints - spatter paint.
2. Plaster leaf casts.
3. Make "insects" from Maple seeds.
4. Collages using nature objects.
5. Draw pictures to go along with experience stories.

Music

1. Listening to and singing appropriate songs.
   (Many suitable one in P1 music book and record albums.)
2. Play singing games.
3. Compose songs.

Health - Emphasize fact that it is good to be outdoors as much as possible.

Physical Education - Stress the value of WALKING.

(It isn't necessary to be driven a block or so to school. "Isn't it fun to take a walk? Don't we learn a lot by walking along - listening, looking, smelling, and feeling? You could do this as you walk to and from school each day.")

At this time, I am more interested in the "Nature Walk" than in the farm but hope to achieve both goals sometime during this next school year.

For my own practical application, I plan to find a suitable wooded area closer to Paducah than LBL (the park if unsuccessful elsewhere) and to take the class there about three times throughout the school year to observe the area at various seasons and note the changes.

It is my fond hope that sometime in the not too distant future Paducah will have its own area for an "outdoor education laboratory". Surely a wooded area may some day be at our disposal and eventually a farm (with animals - an almost thing of the past around here) and as long as I am dreaming - a nature museum would be an asset also.

Thanks for such an outstanding course. Never have I learned so much in such a short length of time and had such a good time doing it.

Jane McBride

LAND BETWEEN THE LAKES
1970 PROGRAM
CENTRAL INTERMEDIATE
NAME________

A COMPLETE ORGANIZATIONAL PLAN FOR A THREE-DAY STUDY SESSION AT THE LAND BETWEEN THE LAKES

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I. PHILOSOPHY

A. To acquaint and learn methods of studying how nature and man can exist together. The natural environment (nature's playground) is the perfect classroom for these learnings to take place. It is important for the children to learn and live the terms describing preservation and conservation. This is important because the future of our natural surroundings, in order to prosper, must be understood and protected by the up-coming generations.

II. WHAT TO BRING AND NOT TO BRING

A. Children should bring:

1. boots, jacket, and raincoat.
    a. The weather will not stop the education in the field.
2. 3 changes of socks.
3. 2 changes of underwear.
4. plastic baggies to collect material.
5. magnifying lenses, binoculars (if you have them).
6. pencils
7. towels, washcloths
8. soap, toothbrushes, combs, deoderant, and other personal objects of necessity

B. Children should not bring:

1. money
2. radio
3. food
4. linen
5. jewelry
6. No medication unless it is absolutely necessary. No instructor will administer medication, but we would like to know if anyone is taking it.
7. Candy, or gum (snacks will be provided).

III. CLIMATIC

A. Weather watch:

1. exercise
   a. Materials: thermometer, compass, pencil, and pad.
      (a). What is the temperature? ____________________
      (b). What direction is the wind blowing from? ____________________
      (c). Is the wind light, moderate, strong? ____________________
      (d). Is fog or dew present? ____________________
      (e). Is it clear or cloudy? ____________________
      (f). Is it raining?__________or is it snowing? ____________________
      (g). What can you see in the sky? ____________________
      (h). Is the sun high or low? ____________________
      (i). What colors can you see? 1.____________________
      2.____________________
      3.____________________

2. Look at the tree coverage. Why are there trees growing in certain areas, and none growing in other area?
3. Explain the decomposition cycle of dead trees, leaves, and other vegetation.
4. Study the animal signs (tracks).
5. Study the birds (home flock, honkers, swans, teal, mallard).
6. Make plaster casts of animals prints.

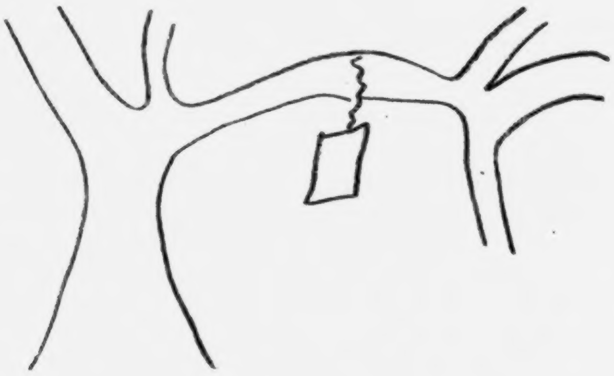
B. Modern Conservation:

1. pollution
   a. Describe the methods of polluting the air, water, and land.

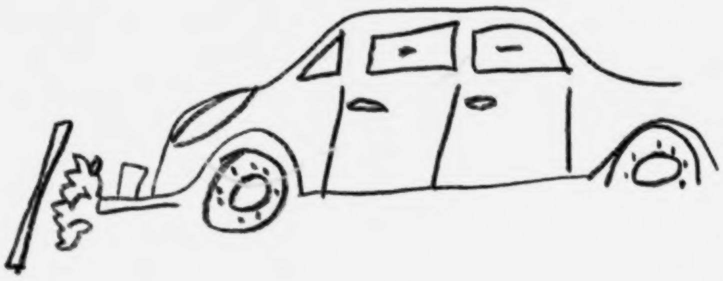
   b. Describe how we can prevent pollution, and clean up what pollution we now have.

C. Air Pollution

1. Suspend a pice of glass covered with a clear sticky film in the air and in a day, or so observe the materials that have stuck to the glass. Where does this air pollution come from?

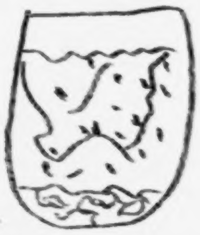


2. Set a glass of water out in the open air. In a day, look to see if there is any pollution in the glass. Where does the pollution come from?
3. Discuss with children how they aid to air pollution.
4. Hold a piece of white paper in back of a car's exhaust for a few minutes. What happened to the paper? Can you imagine breathing this!
5. Ask children what would happen if they sat inside a closed garage with the car running.

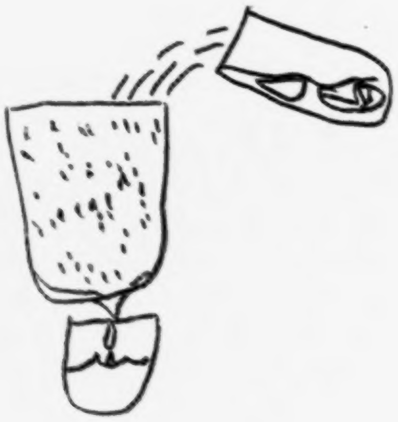


D. Water Pollution:

1. Distinguish between organic and inorganic matter in the water in the water.
2. With a paper cup take a sample of water from the lake and examine it for impurities.
3. Explain how the bacteria and algae help break down the impurities in the water.
4. The lakes and rivers will clean themselves, if given time. Mix some dirt with water, and let it set for a few hours. The sediment and dirt will sink to the bottom leaving the water fairly clean



5. Pour dirty water through cup of sand to show how nature can cleanse the water through filtering over the land.



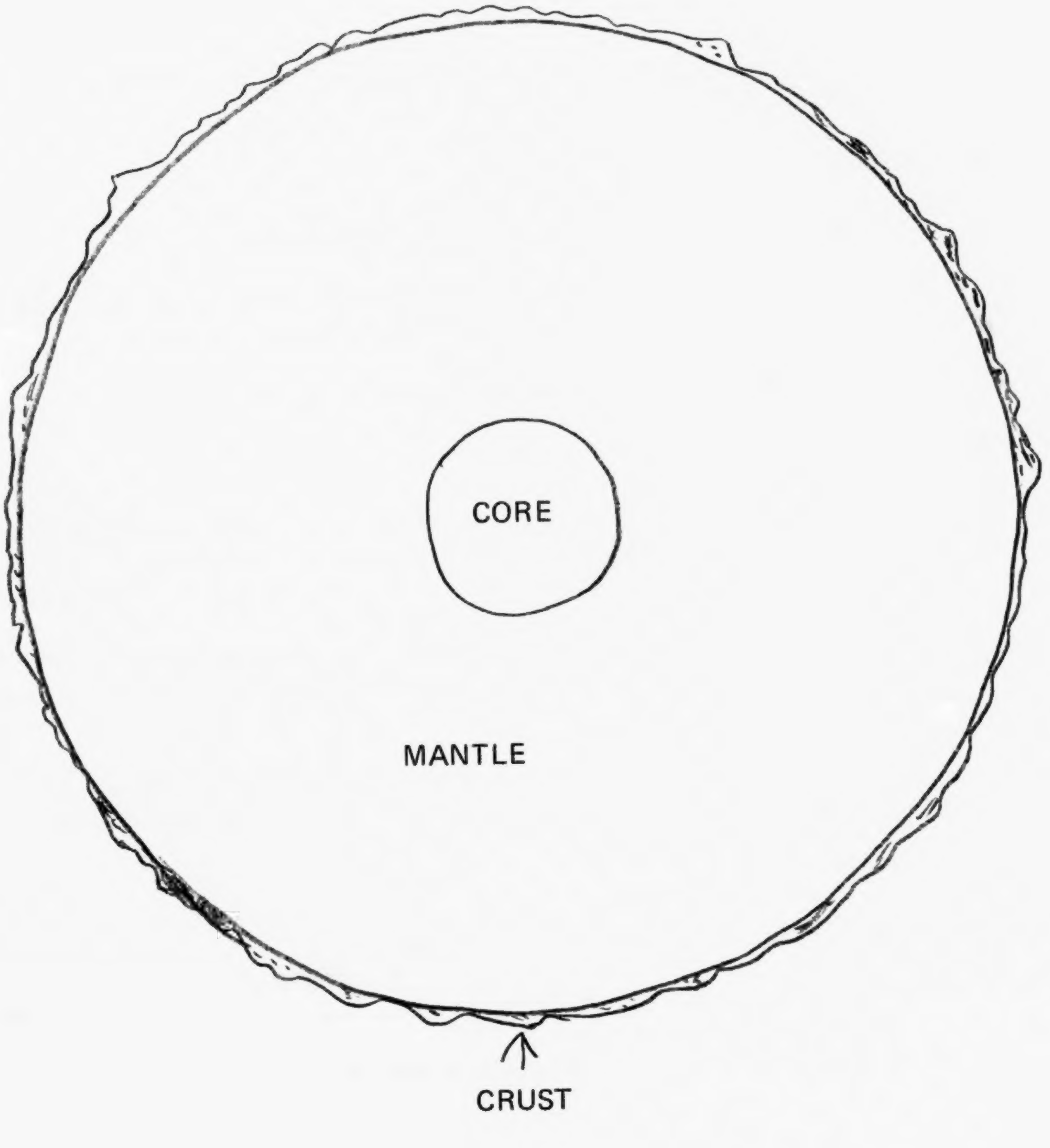
IV. SOCIAL SCIENCE -- (GEOGRAPHY)

A. Map exercise of Hematite Lake.
   a. Hand out map of Hematite Lake.
   b. At the scene of Hematite Lake, orient the map with the compass.
   c. Show the children where they are on the map.
   d. Describe the degrees on the compass.
   e. As they are following themselves around the lake take a compass reading every 200 feed and write it on the map.
   f. Plot all signs of pollution found.
   g. Plot on the map the different animal signs found (example: Beaver Lodge)

TERMS TO DEFINE:

1. Orient - A lining up of the map according.
2. Compass - A north, south, east, and west machine used to find directions in relation to a magnetic pull by the north pole on the needle.

Cross-Section of the Earth


CORE
MANTLE
CRUST

(INCLUDES TOP SOIL, MOUNTAINS, VALLEYS, OCEAN TRENCHES, PLAINS, PLATEAUS ETC.)

B. History:

1. Discuss the early indians that lived around this area.
2. Discuss the early iron mills in this area.
    - (a). Include the use of hardwood, iron ore and old roads.
    - (b). The early villages.
    - (c). The pig iron and slag
3. Discuss the early cemeteries of this area.
4. Discuss the boot-leggers that were here at the turn of the area.
5. See silo-overlook, iron mill, museum, and the farm.

C. Geology:

1. Explain the different rocks and their formations around the Geology Center.
2. Collect and exmine fossils.
3. Discuss erosion and the make-up of the soil.
4. Look for fossilized clams, lilies, brachiopods and other forms of ancient life.

D. Ecology:

1. Examine and discuss the aquatic pond.

2. Iron Hills Area-Examine under logs and rocks to find homes of insects, lizards, and warm blooded animals.

3. Discuss coniferous and deciduous trees.

E. Soil Study Exercise:

1. Distinguish between plant material (organic matter) present in soil and mineral material (inorganic matter).
2. Examine a soil sample between your fingers. Can you identify particles of sand, silt, and clay?
3. Squeeze soil samples together in your hand. Do they form a ball? What does this indicate to you concerning moisture content?
4. Talk about how soil is formed.
5. How does the forces of nature help to produce soil?
6. Study the cross-section of the earth and explain its sections.

V. DEFINITIONS

A. Orientation of groups will include:

1. Make sure children have proper equipment. (pencil, paper, and proper clothing).
2. Rules concerning dormitory and conduct as a student.

B. Geology:

   1. The study of the rocks and soil and how they relate to the geography and history of this area.

C. Ecology:

   1. The study of the vegetation and animal life of this area.

D. Climate:

   1. The condition of the atmosphere over a long period of time.

E. Weather:

   1. The condition of the atmosphere over a short period of time.

F. Modern Conservation:

   1. This refers to philosophy at the front of the booklet.

G. Water Safety:

   1. A knowledge of the respect for the safety and power of water.

H. History:

   1. A knowledge of the ancient and modern development of the Land Between the Lakes.

I. Geography:

   1. A study of a portion of the earths' surface, a map of the area and a silva compass will be used.

J. Art:

   1. A creative approach to understanding the beauty and description of the natural surroundings.

K. Pollution:

   1. The undesirable methods of contaminating and throwing the balancing of nature off its natural course.

L. Environment:

   1. The immediate surroundings that effects our present living and learning situation.

M. Island:

1. Completely surrounded by water.

N. Peninsula:

1. Water on three sides.

O. Vegetation:

1. Living or more living plant life.

VI. FREE MATERIALS FOR PRE-AND POST-WORK ACTIVITIES

1. St. Regis Paper Company
150 Cast 42 Street
New York 10017

2. The Kentucky Department of Natural Resources
Frankfort, Kentucky 40601
(Booklets on conservation, water, and soil.)

3. Public Relations Department
Inland Steel Company
30 West Monroe Street
Chicago, Illinois 60603

4. Natural Rubber Bureau
1108 16th Street, N. W.
Washington, D. C. 20036

5. American Petroleum Institute
1271 Avenue of the Americas
New York, New York 10020
(portfolio of colorful conservation folders with a description.)

6. National Cotton Council of America
P. O. Box 12285
Memphis, Tennessee 38112
(Books and charts on cotton)

7. American Petroleum Institute
1271 Avenue of the Americas
New York, New York 10020

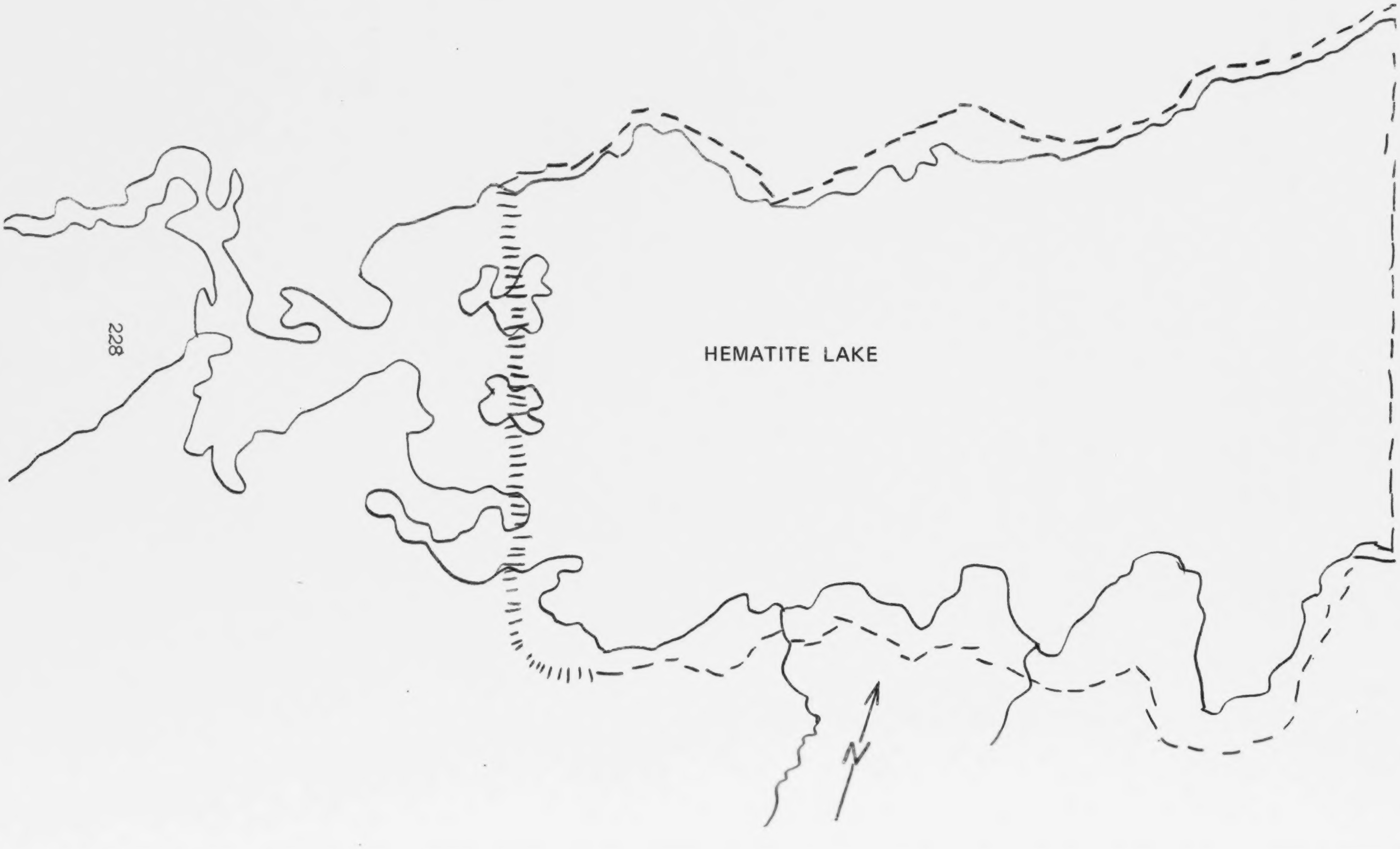
8. General Electric Co., 1966
P. O. Box 8555
Philadelphia 1, Pennsylvania

9. National Coal Association
Coal Building
Washington, D. C. 20036
(Free Coal Kit and other information)

10. Western Wood Products Association
Yeon Building
Portland, Oregon 97204
(portfolio on trees of the United States and their products.)

BE SURE:

1. Use school stationery.
2. Explain intended use of information.
3. Type, when possible.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OBSERVATIONS

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SAMPLE THREE DAY SCHEDULE

Jackson Elementary School
Environmental Education
March 26 thru 28, 1969

STAFF

Leslie B. Sternberg, Project Leader
Addie Mae Helm
Betty Palmer
Margie Shanklin
Barbara Wright
Gary Trentham
Dale Trentham

YOUTH PERSONNEL

Melinda Crutchfield
Robyn Jo Cates
Susan McGuirk
Karen Lund

Wendesday, March 26

11:00 - Leave Paducah by bus
12:00 - Arrive at Y. A. S. - Eat lunch, settle gear in dorm
1:30 - Orientation Period - Sternberg

2:00 -	Red Group - Map & Compass	Helm Shanklin Wright McGuirk
	Blue Group - Map & Compass	G. Trentham Crutchfield
	Green Group - Map & Compass	Palmer Lund
	Brown Group - May & Compass	D. Trentham Cates

At this time the groups will be divded into teams and share a compass and map. You may use this time to visit the farm, see the Silo Overlook, Honker Dam or any other points of interest.

4:30 - Mini-exercises - Sternberg
6:00 - Supper
7:00 - Campfire(out of doors if possible) Songs and local history
8:30 - Movies in dining hall - Sternberg
Snacks
9:30 - Prepare for bed
10:00 - LIGHTS OUT

Thursday, March 27

7:15- Rise & Shine
7:45- Flag Raising - Helm
8:00- Breakfast
9:00- Red Group - Math & Art - Helm
Wright
McGuirk

Green Group - Stream & Valley - G. Trentham
Crutchfield

Blue Group - Ecology - Palmer
Stanley

Brown Group - Geology - D. Trentham

11:45- Clean Up for Lunch
12:00- Lunch
1:00- Red Group - Stream & Valley - G. Trentham
Crutchfield

Green Group - Ecology - Palmer
Lund
Blue Group - Geology- D. Trentham
Cates
Brown Group - Math & Art - Helm
Shanklin
Wright
McGuirk.
4:45- Clean up for supper
5:00- Supper
6:00- Campfire (out of doors if possible)
Sing Songs
7:00- Night watch and animal hunt by groups
Red Group - Sternberg & Lund
Green Group - G. Trentham & McGuirk
Blue Group - D. Trentham & Crutchfield
Brown Group - Palmer & Cates
8:30- Movie & Snack - Shanklin, Helm & Wright
9:30- Prepare for bed
10:00- LIGHTS OUT

Friday, March 28
7:15- Rise & Shine
7:45- Flag Raising - Palmer
8:00- Breakfast
9:00- Red Group - Geology - D. Trentham
Cates
Green Group - Math & Art - Helm - Shanklin - Wright - McGuirk

Blue Group - Stream & Valley - G. Trentham - Crutchfield
Brown Group - Ecology - Palmer & Lund

11:45- Clean up for lunch

12:00- Lunch

1:00- Red Group - Ecology - Palmer & Lund
Green Group - Geology - D. Trentham & Cates
Blue Group - Math & Art - Helm, Wright, Shanklin & McGuirk
Brown Group - Steam & Valley - G. Trentham & Cruthfield

3:30- Clean dorms & pack gear (make sure the dorms are as clean or cleaner than you found them.)

5:00- Supper

6:00- Board buses, leave for Paducah

7:30- Arrive in Paducah

Paducah Environmental Education
Land Between the Lakes - Clark School
Nov. 19-21, 1970

Staff:

Project Leader - Dorothy Kirchhoff
Instructors - Marrette Calloway
Mary Anderson
Lynn Hodges
Larry Salmon
Dutch Bryant

Student Instructors - Mike Pinnegar
Chuck Maidment
Keith Brown

WEDNESDAY

10:30 Leave School
11:45 Arrive Y. A. S.
12:00 Lunch
Settle in dorms
1:00 Honkers - Mr. Salmon-Geology and Stream & Valley
Fallows - Mr. Hodges-Conservation and Animal Habitats
Hematites - Mrs. Calloway-Cemetery and Contour Mapping
British Soldiers-Ecology-Mrs. Anderson
5:00 Clean up for dinner
5:30 Dinner
6:15 Fallows and Honkers - Night watch
Hematites and British Soldiers - Art
8:00 Hematites and British Soldiers - Night watch
Fallows and Honkers - Art
9:30 Film
10:00 Get ready for bed
10:30 Lights Out!

THURSDAY

6:30 Everyone up
7:00 Flag Raising
7:10 Breakfast
8:00 Honkers - Mr. Hodges
Fallows - Mr. Salmon
Hematites - Mrs. Anderson
British Soldiers - Mrs. Calloway
12:00 Lunch
1:00 Honkers - Anderson
Fallows - Mrs. Calloway
Hematites - Mr. Hodges
British Soldiers - Mr. Salmon
4:00 Day into Night Watch-Mrs. Kirchhoff
5:00 Clean up for dinner
5:30 Dinner
6:15 Fallows and Honkers - History
Hematites and British Soldiers - Animal Watch
7:30 Hematites and British Soldiers - History
Fallows and Honkers - Animal Watch

8:30 Campfire
9:30 Film
10:00 Get ready for bed
10:30 Light Out!

FRIDAY

6:30 Arise
7:00 Flag Raising
7:10 Breakfast - Pack to go home
8:00 Honkers - Mrs. Calloway
    Fallows - Mrs. Anderson
    Hematites - Mr. Salmon
    British Soldiers - Mr. Hodges
11:30 Move out of dorms
12:00 Lunch
12:30 Leave for home
2:15 Arrive back at school

FIELD GROUPS

FALLOWS

Lisa Amick
Jane Johnston
Julie Daniels
Mary Holland
Grace Pedley
Melinda Poore
Laura Harrelson
Carolyn Hickey
Amy Nelson
Janice Ridgeway
Patricia Moss
Carol Herron

HEMATITES

Dan Boaz
Philip Foster
Steve Owen
Craig Pittard
Mike Young
Al Stainback
Jay Grace
Steve Colby
Mark Redden
Jay Rudolph
Kenny Ryan
Billy Yates
Gary Hopper

HONKERS

Nancy Blair
Pam Garrett
Peggy Morello
Kim Warren
Jennifer Stroup
Carol Whitehead
Karen Haney
Leah Tinsley
Sharon Grubbs
Kathy Rickman
Angela Loe
Lisa Rushing

BRITISH SOLDIERS

Scott Gossett
Keith McKenzie
Steve Parrott
Steve Ray
John Russell
Bobby Turok
Greg Coleman
Donnie Rogers
Ev Lyles
Mike Sanderlin
Lane Wall
Larry Stewart

KITCHEN AND DINING ROOM DUTIES

Report to the kitchen 10 minutes before the meal to help serve.

Get in line to be the first served.

After the meal help load the dishwasher, wipe off tables and sweep.

SCHEDULE

Wednesday Lunch	Dorm 1
Wednesday Dinner	Dorm 2
Thursday Breakfast	Dorm 3
Thursday Lunch	Dorm 4
Thursday Dinner	Dorm 5
Friday Breakfast	Dorm 6
Friday Lunch	Dorm 1

DORMITORIES

Dorm 1

- Lisa Amick *
- Mary Holland *
- Melinda Poore
- Lisa Rushing
- Carol Whitehead*
- Carolyn Hickey
- Patricia Moss
- Kathy Rickman

Dorm 2

- Nancy Blair
- Jane Johnston*
- Grace Pedley
- Jennifer Stroup*
- Laura Harrelson*
- Amy Nelson*
- Janice Ridgeway
- Carol Herron

Dorm 3

- Julie Daniels*
- Pam Garrett
- Peggy Morello*
- Kim Warren
- Karen Haney*
- Leah Tinsley*
- Angela Loe*
- Sharon Grubbs

Dorm 4

- Dan Boaz*
- Keith McKenzie
- Craig Pittard*
- Mike Young
- Greg Coleman
- Mark Redden*
- Jay Rudolph*
- Lane Wall

Dorm 5

- Phillip Foster*
- Steve Owen*
- Steve Ray
- Al Stainback
- Jay Grace
- Gary Hopper*
- Donnie Rogers*
- Kenny Ryan

Dorm 6

- Scott Gossett*
- Steve Parrott
- John Russell*
- Bobby Turok
- Steve Colby*
- Billy Yates
- Ev Lyles
- Mike Sanderlin
- Larry Stewart*

*Means that these students see the work is done but EVERYONE helps keep the dorms clean.

Dear Parents:

On ______________________________ we will have an orientation meeting in the auditorium for parents of children participating in the "Land Between the Lakes" area ________________________, ___________________________, and ______________________________. We are happy to tell you that there will be no charge for the trip itself. However, if your child is not currently covered by school insurance or some kind of Home Owners policy, we ask that you take out some insurance at this time. School insurance may be obtained for $3.00. We hope that you will be able to come over on _________________________ so that we will be able to answer any questions that you may have.

Sincerely,

Principal

SAMPLE LETTER AND PERMISSION SLIP

FOR PARENTS

Dear Parent:

The Paducah School System is constantly striving to provide better learning experiences for your child. Many of the programs taught at the present time were at the experimental stage only a few years ago. We hope that you feel as we do that the search for different and better ways for children to learn has been rewarding.

In keeping with this program of improvement the Paducah School System is sponsoring an outdoor education field trip for classes from our school system. All fifth grade and selected secondary students will participate in this program this year.

The purpose of this field trip will be to provide learning experiences in the outdoors in the following areas:

1. Plant Ecology
2. Animal Ecology
3. Local and regional history
4. Geology and topography
5. Conservation and nature appreciation

The field trip will last for two and one-half ($2\frac{1}{2}$) days and two (2) nights at the fifth grade level and two (2) days and one (1) night at the junior high level. Your child's class will participate in the outdoor education project on ________ ____________ and ______________________. His class will leave approximately at _______________ on the first day, and will return at approximately ____________ on their last day.

This program in Outdoor Education will be conducted at the Conservation Education Center in the Land Between the Lakes. Meals and lodging will be provided in the Youth Activities Station.

> "The Youth Activities Station is located in the Conservation Education Center, a 5,200 acre area within the boudaries of the Land Between the Lakes National Outdoor Recreation Area. Situated on a small point jutting out into Lake Barkley, it has been developed by the Tennessee Valley Authority for use by school systems throughout the southern, central, and eastern United States.
>
> The Youth Station is designed to accommodate two classes, 60 students with their teachers and counselors. Although the living accommodations were developed specifically for fourth-through-ninth graders, they may be used by groups who do not fall within this category. Individual school groups are welcome to use the outdoor campus for periods ranging from two days to two weeks. Some schools in the region immediately surrounding Land Between the Lakes have used the area for a series of

> one-day field trips. A resident program, however, can offer a more complete well-rounded experience with the added advantage of having students living and working together.
>
> Tennessee Valley Authority personnel handle the food service at the Youth Activities Station, giving students and teachers opportunity to devote full time to educational activities. Food is prepared and served from a modern kitchen using packaged meals. The menu includes dishes ranging from hamburgers to crab tetrazzini.
>
> While visiting the Youth Station students and teachers will live in six dormitories, each designed to sleep 10 youths and two adults. Blankets and pillows are provided, but each person will generally be required to bring his own linens."

All cost for the program will be paid by the school system. On the following page you will find a list of clothing your child will need. Transportation will be provided by regular school buses owned and operated by the Paducah Public Schools.

Before your child can participate in this educational program it will be necessary for you to give your permission for him to participate at the Conservation Education Center at the Land Between the Lakes. Please sign and return this form to your child's teacher.

We, the parents of ______________________________ grant permission for our child to participate in the school sponsored field trip.

____

Parent's Signature

In order for your child to participate in this field trip, it will be required of him to have adequate accident insurance coverage, and permission from his parents.

The Wabash Insurance Company's student insurance plan ($3.00 for school day and school activities and $12.00 for twenty-four hour coverage.) that you have on your child this current school year is sufficient. If your child is not covered by the Wabash Insurance Company's student plan, your family accident insurance policy will be acceptable. The parent or guardian is responsible for determining whether or not their family plan provides adequate accident coverage.

If you are not carrying the Wabash Insurance Student Plan and are depending on your family accident insurance policy, please indicate on the line below the name of the insurance company, which provides your accident coverage.

____
Name of Company

- -

If for any reason you do not have the Student Accident Insurance or family accident insurance, you may purchase the Student Accident Insurance from your child's school for $3.00.

We are looking forward to working with your child in this educational endeavor.

Sincerely,

Richard B. Brown,
Assistant Superintendent
PADUCAH PUBLIC SCHOOLS

James M. Major
Subject Matter Specialist in Science
   and Environmental Education
PADUCAH PUBLIC SCHOOLS

RBB/JMM.jhw

CHECKLIST FOR STUDENTS ON 3 DAY STAY

I. Clothing

1. Comfortable walking shoes (tennis shoes are not acceptable)
   2 pair boots
2. Socks -- 4 pairs
3. Light jacket (water-proof is preferable) and raincoat
4. Sweater or sweat shirt
5. Ankle--length slacks (no shorts or skirts) -- 2 or 3 pair
6. pajamas
7. Under clothes for 3 days.

II. Linens

1. 1 towel
2. 1 wash cloth
3. toothbrush, toothpaste, etc.

III. Equipment - All of these items are optional

1. Compass
2. Binoculars
3. Camera
4. Notepad (pocket size) and pencil
5. Canteen
6. Overnight bag for clothing

IV. Items NOT to bring

1. Knives
2. Food and chewing gum
3. Radio
4. Bulky suit case
5. Fire works

(Different lengths of stay at YAS will make changes in above list.)

CHECKLIST FOR PROJECT GUIDE

I. Equipment

1. flashlight
2. first-aid kit
3. tape recorder
4. recreational equipment
    a. record player and folk dance records
    b. drawing paper and charcoal
5. Map - big and little

CHECKLIST FOR TEACHERS

I. Suggested Clothing - same as children

II. Equipment

1. flashlight
2. baggies (one for each of your students)
3. kleenex supply
4. list of student names, phone numbers, and addresses
5. outline map for each student.

III. Preparation

1. permission slips collected
2. name tags with safety pins
3. organization of students groups by sex

NOTE: On permission slips ask parents if child has any health problems we should be aware of before taking him or her on a two-day trip.

CLASSROOM TEACHER EVALUATION OF A ONE-DAY FIELD TRIP
TO THE LAND-BETWEEN-THE-LAKES
WITH TWO CLASSES OF FIRST GRADE CHILDREN

To: Jim Major, Director of Environmental Education

From: Nancy Daniels, Morgan School and Jane McBride, Whittier School

Re: Field Trip to LBL, May 13, 1969

The trip to the Land Between the Lakes with six- and seven-year-olds proved to be a success. One anticipated problem that did not materialize was that of keeping the children entertained during the hour and a half bus ride to the LBL. The children took care of this themselves. They were quite intrigued with the bus ride and the things they saw along the way. When interest in this lagged, they sang.

Another problem to take into consideration with young children is that of restrooms but the children made it nicely to the Visitors Center where there were plenty of facilities. Also at the Center, the children were fascinated by the stuffed animals, especially the beaver. Even the wild animals cooperated on this trip. We saw three deer, a woodchuck, a raccoon and a "huge black snake."

This was the first trip to the LBL and/or to a farm for many of the children. The farm and the snake were the highlights of the trip. While at the farm, the children not only saw but were allowed to pet a four-day-old baby kid, Daisy, the cow and Charley, the lamb. They also saw ducks, a goose, a turkey, rabbits, horses, mules, a pony, sheep, goats, barn swallows, and their nests, and the farm cat. They especially enjoyed the baby rabbits and seeing the lamb get its dinner from the cow.

While one group was observing the animals, the other group toured the museum, compared the old and new farm equipment, took hikes and/or had a Day Watch.

Mr. Veasy, manager of the farm, felt that the children responded enthusiastically and hopes that next year the Paducah School System will allow more of its younger children to visit the Empire Farm.

After leaving the farm, we went to Hematite Lake for lunch. The cafeteria workers at the respective schools had prepared sack lunches and provided milk in ice chests for everyone. While some of the adults prepared for lunch, the children went to the deer pen. Following lunch and one last quick stop at Center Station, we reluctantly started back to Paducah. The return trip was no problem either for the children rested much of the way back.

We consider this trip an educational one and feel it would be worthwhile for other classes. However, it would be better if the buses were available for a longer period of time so that more time could be spent in the area--time to visit other points of interest, time for nature walks, etc. But all things considered, this was a very good learning experience. As one child summed it up, "We had a good day and we learned a lot."

EVALUATION OF TRIP TO LBL MARCH 26, 27, and 28, 1969
CLARK AND FOREST HILL SCHOOLS

INSTRUCTION - Excellent. The wind made it difficult to teach in the field. The teachers solved this by having a longer period of instruction before going into the field. These sessions were held in the various dormitories. I was able to be with each teacher at least part of one period and was very pleased with what was being taught.

ECOLOGY - Miss McBride had very definite plans made and usually was about to complete them with each group. She returned via the farm and this was a highlight as the sheep were lambing. Two groups arrived at the farm just after lambs were born. (Twins and triplets) That was real cooperation!

STREAM AND VALLEY - Mr. Winn used the stream over by Gross's valley. Excellent sketches were made on each trip. He returned via the museum. He also took the responsibility of the van. This I appreciated.

COMPASS AND CONTOUR MAPPING - Mrs. Kirchoff learned a lot about the compass and contour mapping with the children. The students were all successful in the mapping. Mr. Kirchoff has made some suggestions to improve our surveying and is donating some real survey equipment to our operation.

ANIMAL TRACKS AND HABITATS - Mr. Chapman felt a little disappointed as the weather interferred with some of his plans. However, he did get some very good casts of tracks. The children were very interested in this. His exercise is very good and an excellent contribution to our overall program.

ART - Miss McBride had some very good leaf prints, collages and sketches.

IDENTIFICATION - Mrs. Kirchoff felt that the students that had been involved in the new science program (ESS?) were outstanding in their ability to look for information they needed rather than wait for her to tell them. They were able to observe microscopic animals but desired a better microscope than the one available.

ANIMAL WATCH - It just takes Old Pros like Mr. Winn and Mr. Chapman to find the animals. 68 deer were seen by one group one evening. 63, 58, and 38 I believe were the number seen by the other groups. Two skunks in one evening is good too. Foxes, raccoons, possums, rabbits, groundhogs and others were enjoyed. A few snakes were reported. I don't know how official the reports were. Personally, I enjoyed a red-tail hawk from a closer range than I ever had before.

HISTORY - Each group had about an hour with me on the history. They showed a lot of interest.

DRAMATIZATION - After dinner the students returned to their dorms for about thirty minutes and prepared a skit or some entertainment for our fireside program. The Forest Hill Girls were outstanding in their presentation of Harper Valley PTA.

MOVIES - We showed "Life in the Forest", "Life on a Vacant Lot", "Birds", "Animal Homes", "Numerals Everywhere", "The Beaver", and "Patterns of the Wild". Didn't any of the children see all of these, but all of the children saw some of them. I didn't care for "Numerals Everywhere".

HIGH SCHOOL STUDENTS - They showed a real interest and maturity. Lee Harned was outstanding. He had more experience than the others too. Paul Chelsea definitely was dependable. Ruby [illegible] was most enthusiastic. Danny Beard was very good, too. They boys' attitudes were tops. They at all times seemed to have the respect of the fifth graders and never once was there any conflict with a teacher. They were eager to learn more about all the activities and so it was their decision to rotate rather than stay with one teacher all the time. This is good as they are now better trained.

CLASSROOM TEACHER-We were fortunate enough to have enough trained teachers so Mrs. Mitchell could participate in all the subject areas. She really applied herself and now is sufficiently trained in these areas to teach in LBL.

GENERAL OBSERVATIONS-The one outstanding thing about this trip, to me, was the excellent cooperation and enjoyment the staff seemed to have with each other and the students. Some of the teachers remarked about the relaxed feeling. This is something my trips have needed. This was possible by having an adequate, well-trained staff.

The success in conditioning the students to the weather.

There was no discipline problem. No child became ill. There was only one absentee at Clark Thursday. No major accidents. A few hoarse, but no reported sore throats or ear aches. One child went home Tuesday-homesick.

SCHEDULING - The day periods were four houts long and the evening about an hour each. One teacher felt that the four hour day periods were too long, another commented on how much she liked having the students for this long period. I liked the long periods. It enabled us to take the students to the farm and museum in small groups. I think this might have had something to do with the relaxed, unpressured feeling while there too.

We were unable to do the nightwatch due to the weather.

SUGGESTION- If we had about two five gallon gasoline cans to take with us it would save time and money. The van doesn't hold much gas or uses a lot, and everytime we go for gas that is an extra 50 miles-besides it takes one person about an hour and a half to go for it.

L.B.L. Trip as Evaluated by Betty Palmer, Classroom Teacher and Guide:

All changes that I have noticed have been an asset to classroom teaching. Therefore, I will put these noted differences in a brief form that I hope will be readable.

A. Human Relations-
  1. Pupils and teachers became better acquainted
  2. Pupil-teacher talk became more free and frequent
  3. Pupils' acceptance of each other increased
  4. Pupils became more independent
  5. Pupils weak academically proved to be good "out-doors-men"

B. Social Studies-
  1. Map and compass skills were carried over to the classroom.
     -More interest in map study
     -Better understanding of different kinds of maps and reasons for them
  2. Land forms-This seemed to be one of the most valuable concepts carried back to the classroom. Examples: Pupils can see how the lay of the land can be related to the strategy of a battle. They more easily see how the land effects the people and their way of life. They see how water effects the land and people.
  3. History-This made a profound impression. They seemed to remember all of this, especially the "moonshining", graveyards, and iron industry.

C. Language Arts-
  1. Pupils wrote freely of their experiences
  2. Oral communication very free
  3. Great enjoyment of arts and crafts made from nature's objects

These students are still talking about their trip. They didn't feel like they were at school; however, it is this writer's opinion that they learned more in two and a half days out-of-doors than they would have in several weeks in the classroom.

Isn't it thrilling when you see a child see his or her first deer scampering off through the woods or picking up a piece of "reindeer moss" and asking about it?

The teacher enjoyed the trip, too!

Mrs. Betty Palmer is a fifth grade Language Arts teacher. This evaluation was written two months after the trip to the Y.A.S. at the L.B.L.

Evaluation classroom teacher-Margie Shanklin-Jackson School
Written two months after trip. Mrs. Shanklin is a fifth grade science teacher

The Childs Reaction After Returning to the Classroom

The trip was very enjoyable and educational. I feel that the program included something to fit each pupils interest. I was certainly amazed at the less aggressive child. Each of them took an interest in a particular part of science. It was encouraging for me to see these children so excited, and showing that much enthusiasm over learning from nature study. As a result of the trip, some of the students have achieved a greater interest in a particular phase of science and others are enjoying the entire course.

Upon returning from the trip we had voluntary discussion on the things we did and learned at the lakes. The children responded to questions very good. They brought samples of some of the things they had studied previously in the classroom and at the Land Between the Lakes. Each pupil presented and summarized his findings and then added it to the new collections we had started.

Some of the things that were brought back to the classroom for study were; matter from the earth's crust, rocks, mosses, and ferns. Also, in the classroom the children wrote poems and songs about the woodland community they were in.

In our science class the gifted children have become involved in do-it-yourself projects. Many of the projects consist of ideas they had gotten from The Land Between The Lakes, such as, building dams, mural paintings of forest and animals, and making homes for animals. They have also gained a greater appreciation for the animals that we are sometimes able to have in the classroom.

We achieved a greater teacher and pupil relationship. The pupils seem to realize that teachers are human beings, and we too, have feelings. After our return trip they understood what I had emphasized many times, that a teacher can't do her best job of teaching if she is unhappy about the way she is getting along with her class. Since our trip the children have taken many classroom responsibilities on their own and their dispositions have improved toward each other.

Outdoor education has helped me to recognize personality factors that would enhance the childs capabilities in the classroom.

I feel that as a whole the trip was beneficial to all. There are always exceptions in any case. There were those who did not achieve the intended knowledge tobe gained. Yet, they too, learned, and enjoyed many things as some of them had never experienced a trip of this nature before.

Central Intermediate School
Classroom Teacher Evaluations of L.B.L. Trip
Oct. 22-24, 1969

My job at the Land Between the Lakes was to relate to the children the study of ecology. Many students had heard of the terms lichen, fern, moss, and algae, but few really understood what they meant or had seen them in their natural environment. The students could hardly wait to find some of their own after I pointed some out. One factor that amazed me was that the children were always attentive. Many of them exclaimed that it was fun learning this way.

Since I taught the same lesson each day one might think it would become repetitious but each time it was a challenging experience because each group had different questions to be answered and needs to be met. Different groups tried different experiments so that the information of the lesson would be meaningful to them.

As I grew closer to departure time I would hear students expressing wishes to stay longer, live there, or at least be able to return someday.

As an educator I was wondering what percentage of this activity would carry over into the classroom.

I teach reading and our stories in each reading group consist of a wide range and variety of topics. The students when encountering something like the paths of streams, footprints, rocks and lower plant-like life would and still do recall learning about it at Land Between the Lakes.

It is interesting to note that the sixth graders who went to the Land Between the Lakes last year still talk about or remember their experiences.

Jimmie Wehrmeyer

The trip that the fifth grade students participated in at the Land Between the Lakes had influenced their behavior in many respects. Through their enthusiasm and excitement they were to share newer experiences. One could feel a sense of them being free from the routine of their previous milieu. They accepted the responsibilities of working together as a team, both on the trail and in the dormitory.

It was important that the students have a "carry over" from the experiences. The children should have something to carry with them through-out life. The important thing being the fact that there are other places than just Paducah. They were able to observe first-hand the ways of nature and why they are so important to us.

I have prepared an evaluation of what the teaching situation of the field did for the children and what I think the teaching situation of the school and the neighborhood is doing for the students.

This evaluation of the responsibilities, interests and retainment of the students involves the 1968 and 1969 trips.

In the Field	At School
Self responsivilities	Self responsibilities
Excellent	Good

Findings of interest

Excellent

Retainment of experiences

Excellent

Sharing of experiences

Excellent

Findings of interest

Poor

Retainment of experiences

Good

Sharing of experiences

Poor

Harvey Warren

BEHAVIORAL OBJECTIVES

The writing of behavioral objectives for activities or any lesson is not meaningful unless there is agreement on the usage of action verbs. These are not the only possible ones but these ten will serve the purpose in most cases and will be adequate for the writing of behavioral objectives for environmental education activities.

Our agreements about action verbs mean tha whenever you describe a behavioral objective you will use one or more of the action verbs we have agreed upon, and no others. It also means that whenever you see one of these verbs used you will know immediately the kind of behavior the learner is to exibit or acquire.

Before we try using the action verbs, let's review the ten verbs which formed the game of definitions. Mr. Shapes, if you please . . . .

Definition of Action Words

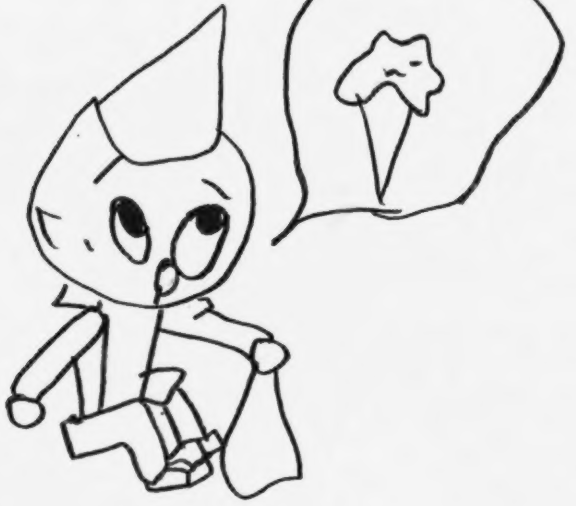
The action words which are used as operational guides in the construction of the instructional objectives are:

1. IDENTIFYING. The individual selects (by pointing to, touching, or picking up) the correct object of a class name. For example: Upon being asked, "Which animal is the frog?" when presented with a set of small animals the child is expected to respond by picking up or clearly pointing to or touching the frog. If the child is asked to "pick up the red triangle" when presented with a set of paper cutouts representing different shapes, he is expected to pick up the red triangles. This class of performances also includes identifying object properties (such as rough, smooth, straight, curved) and, in addition, kinds of changes such as an increase or decrease in size.

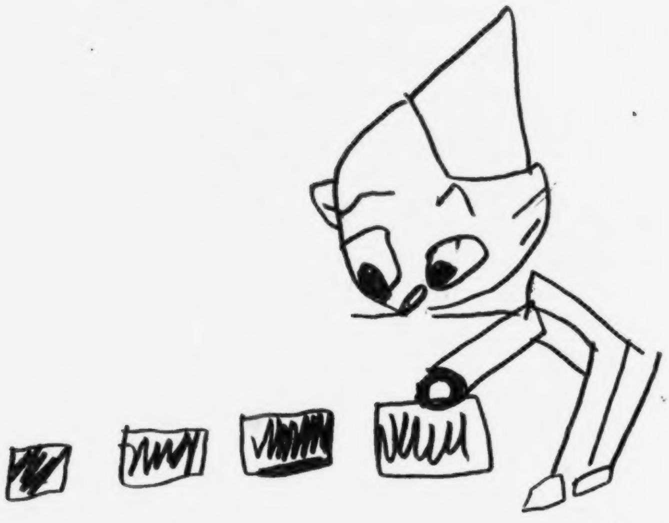
2. DISTINGUISHING. Identifying objectives or events which are potentially confusable (square, rectangle) or when two contrasting identifications (such as right, left) are involved.

3. CONSTRUCTING. Generating a construction of drawing which identifies a designated object or set of conditions. Example: Beginning with a line segment, the request is made "Complete this figure so that it represents a triangle."

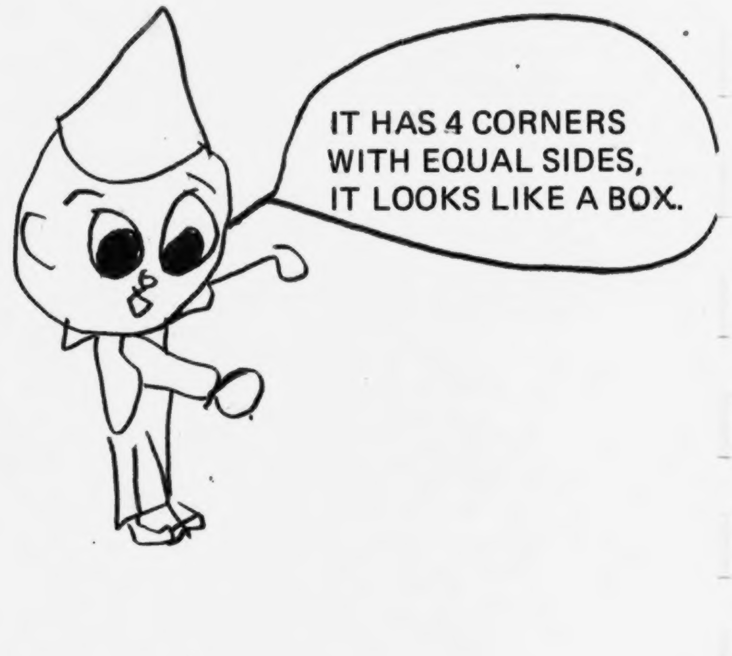
4. NAMING. Supplying the correct name (orally or in written form) for a class of objects or events. Example: "What is the three-demensional object called?" Response: "A Cone"



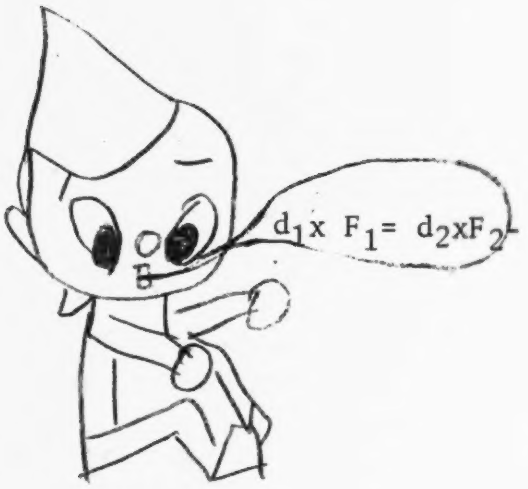
5. ORDERING. Arranging two or more objects or events in proper order in accordance with a stated category. For example: "Arrange these moving objects in order of their speed."



6. DESCRIBING. Generating and naming all of the necessary categories of objects, object properties, or event properties, that are relevant to the description of a designated situation. Example: "Describe this object," and the observer does not limit the categories which may be generated by mentioning them, as in the question, "Describe the color and shape of this object." The child's description is considered sufficiently complete when there is a probability or approximately one that any other individual is able to use the description to identify the object or event.


IT HAS 4 CORNERS WITH EQUAL SIDES, IT LOOKS LIKE A BOX.

7. STATING A RULE. Makes a verbal statement (not necessarily in technical terms) which conveys a rule or a principle, including the names of the proper classes of objects or events in their correct order. Example: "What is the test for determining whether this surface is flat?" The acceptable response requires the mention of the application of a straight edge, in various directions, to determine touching all along the edge for each position.


$d_1 x F_1 = d_2 x F_2$
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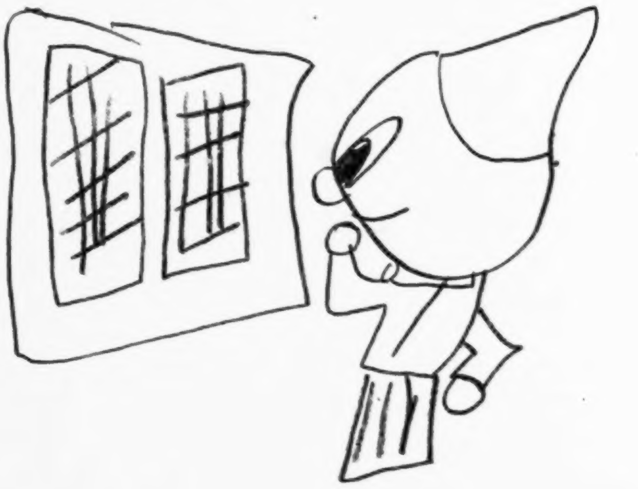
8. APPLYING A RULE. Using a learned principle or rule to derive an answer to a question. The answer may be correct identification, the supplying of a name, or some other kind of response. The question is stated in such a way that the individual must employ a rational process to arrive at the answer. Such a process may be simple, as "Property A is true, property B is true, therefore property C must be true."

9. DEMONSTRATING. Performing the operations necessary to the application of a rule or principle. Example: "Show how you would tell whether this surface is flat." The answer requires that the individual use a straight edge to determine touching of the edge to the surface at all points, and in various directions.

10. INTERPRETING. The child should be able to identify objects and/or events in terms of their consequences. There will be a set of rules or principles always connected with this behavior.



BEHAVIORAL OBJECTIVES

FINAL SUMMARY

1. A statement of instructional objectives is a collection of words or symbols describing one of your educational intents.

2. An objective will communicate your intent to the degree you have described what the learner will be DOING when demonstrating his achievement and how you will know when he is doing it.

3. To describe terminal behavior (what the learner will be DOING):
    a. Identify and name the over-all behavior act.
    b. Define the important conditions under which the behavior is to occur (givens or restrictions, or both).

4. Write a separate statement for each objective; the more statements you have, the better chance you have of making clear your intent.

5. If you give each learner a copy of your objectives, you may not have to do much else.